

Detailed Syllabus Lecture-wise Breakup

Subject Code	17M12EC130	Semester (specify Odd/Even)	Semester EVEN Session 2018 - 2019 Month from Jan. to June 2019
Subject Name	Advanced Wireless Networks		
Credits	3	Contact Hours	3
Faculty (Names)	Coordinator(s)	1. Pankaj Kumar Yadav	
	Teacher(s) (Alphabetically)	1. Pankaj Kumar Yadav	

COURSE OUTCOMES		COGNITIVE LEVELS
CO1	To review of 2G/GSM Network: Evolution of mobile communication systems, Cellular Concept, GSM Network Architecture. Develop an understanding of the TCP/IP and Mobile telecommunication network models	Remembering (Level I)
CO2	To understand the concept of Quality of services (QoS) in data networks. Evaluation wireless data networks (2G/GSM, 3G/UMTS and 3.5G HSPA) architecture in terms of QoS design parameters.	Understanding (Level II)
CO3	To analyze the LTE Air Interface and LTE Core Network	Analyzing (Level IV)
CO4	To evaluate happening between different LTE network elements with the help of various Signaling Scenarios.	Evaluating (Level V)

Module No.	Subtitle of the Module	Topics in the module	No. of Lectures for the module
1.	A review of 2G/3G Networks	Evolution of mobile communication systems. GSM: Network Architecture; Call Scenarios. Quality of services (QoS) in data networks. GPRS/EDGE networks evolutions. UMTS: Network Architecture Concept of CDMA; WCDMA Specifications; Peak data calculations for UMTS, HSDPA and HSPA+	12
2.	Overview of LTE	Evolution of LTE; High Level Architecture (LTE Nodes & Interfaces);	8
3.	LTE Air Interface	Principle for OFDM (including Concept of Orthogonality & Concept of CP (Cyclic Prefix)); Principle of SC-FDMA signal and Limitations of Single Carrier Modulation; OFDMA symbols, parameters, Subcarrier Types; Concept of flexible spectrum usage; Downlink Physical signal and channels; Uplink Physical signal and channels; Physical Layer Structure (Frame Structure, RB, Resource Grid); Duplexing and Modulation Schemes in LTE; LTE Radio Interface Protocol Stack; LTE Radio Interface LTE States	12
4.	LTE Core Network (EPC Core)	EPC Core nodes (MME, S-GW, PDN-GW, PCRF etc.); S1 interface; S1AP Protocol;	5

		NAS Procedures;	
5.	LTE Signaling Scenarios	LTE Initial access; Random access procedure; Initial Context setup procedure; Attach/Detach procedure; Service request; Handover and Call Initiatives/ establishment	8
6	LTE-Advanced LTE -A and 5G - Basics	LTE – Advanced: COMP, CA, Relay, Heterogeneous N/w, MU-MIMO, N/w MIMO, LTE-IOT, Introduction to 5G	4
Total number of Lectures			40

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)	
1.	T. S. Rappaport, Wireless Communications, PHI, 2002.
2.	Gunnar Heine, GSM Networks: Protocols, Terminology and Implementation, Artech House, 1999.
3.	Andrea Goldsmith, Wireless Communications, Cambridge University Press, 2005
4.	Harri Holma, Antti Toskala, LTE for UMTS: Evolution to LTE-Advanced, John Wiley and Sons, 2011
5.	5G Technology Evolution Recommendations, 4G Americas, 2015
6	http://www.3gpp.org/ftp/Specs/html-info/36-series.htm

Detailed Syllabus
Lecture-wise Breakup

Course Code	18M12EC111	Semester Even	Semester 3 rd (M.Tech) Session 2019 Month from January 2019 to June 2019
Course Name	ASIC Verification using System Verilog		
Credits	3	Contact Hours	3

Faculty (Names)	Coordinator(s)	Mandeep Singh Narula
	Teacher(s) (Alphabetically)	Mandeep Singh Narula

COURSE OUTCOMES		COGNITIVE LEVELS
CO1	Study the need of verification, different phases of verification, and creation of verification infrastructure.	Understanding (Level II)
CO2	Understand code coverage, functional coverage and system verilog assertions	Analysis (Level IV)
CO3	Understand the basic constructs in verilog language and coding style for modeling different circuits	Analysis (Level IV)
CO4	Understand the system verilog enhancements over verilog language and constructs in system verilog	Analysis (Level IV)
CO5	Understand how verification environment is build to verify DUT using different components like driver, generator, scoreboard, monitor etc.	Analysis (Level IV)

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Introduction to ASIC Verification	ASIC Design Flow, Validation vs. Verification, Verification Model, Hardware Verification Languages, Phases of Verification, Verification Infrastructure – Stimulus Generator, Driver, Scoreboard, DUT and Monitor, Functional coverage, Code Coverage – Statement, Path, Expression, FSM Coverage, Assertions, Chip Testing – Boundary Scan, BIST	4
2.	Verilog	Introduction, Verilog Module, Module Instantiation, Data Types – Reg, Wire; Verilog Operators – Arithmetic, Logical, Relational, Equality, Reduction, Bitwise; Modelling – Structural, Behavioural and Dataflow, Control Statements, Initial Block, Always Block; Function, Task, Blocking Vs.Non-Blocking, Logic synthesis, Simulation Synthesis Mismatch	10

3.	System Verilog	Introduction, Features, Module, Data Types – 2 valued & 4 valued; Arrays, Logic Operators & their types; Fork Join Statement and their types; Random Number Generation; SV Packages; Tasks & functions; SV Parameters; SV Test Bench; Race Condition; Clocking Block	10
4.	Test Bench & Verification Environment using System verilog	Test Bench Model, Directed Tests, Random Verification, Linear Test Bench, Linear Random Test Bench, Self-Checking Test Bench; Module Instantiation Methods; Stimulus Techniques – Using Initial Block, Always Block, Array of Vectors, & Forced Stimulus; Verification Environment Hierarchy – Stimulus Class, Driver Class, Monitor Class, Scoreboard, Checkers etc	10
5.	System verilog Assertions & Coverage	Covergroups, coverpoints, coverage groups, coverpoint expressions, coverage bins, explicit bin creation, transition bins, wildcard bins, ignore bins, illegal bins, cross coverage, coverage methods, cover property, SV assertions and types	8

Total number of Lectures	42
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Evaluation Criteria

Components	Maximum Marks
T1	20
T2	20
End Semester Examination	35
TA	25
Total	100

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

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| 1. | System Verilog for verification by Chris Spear, 3rd Edition, Springer |
| 2. | Hardware Verification with System Verilog (Authors: Mintz, Mike, Ekendahl, Robert), Springer |

Detailed Syllabus
Lecture-wise Breakup

Course Code	19M12EC111	Semester : Even 2019 (specify Odd/Even)	Semester IInd Session 2018 -2019 Month from Jan – May 2019
Course Name	Adaptive Filters		
Credits	3	Contact Hours	3

Faculty (Names)	Coordinator(s)	Dr. Vikram Karwal
	Teacher(s) (Alphabetically)	Dr. Vikram Karwal

COURSE OUTCOMES		COGNITIVE LEVELS
CO1	The course aims to familiarize student with need of adaptive systems and their properties	Apply Level (C3)
CO2	The course helps students to study algorithms useful for optimization of adaptive systems such as Stochastic Gradient Algorithms	Analyze Level (C4)
CO3	The course helps students analyze the performance of adaptive system such as convergence rates and mean-square error criterion	Evaluate Level (C5)
CO4	The course helps student design adaptive systems for real time stochastic systems	Create Level(C6)

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Review and Background Material	Linear Algebra: Hermitian and Positive-Definite Matrices, Schur Complements, Cholesky Factorization, QR Decomposition, Kronecker Products, Complex-Valued Random Variables, Vector-valued Random vectors, Complex Gradients, Cauchy-Riemann Conditions	5
2.	Linear Estimation	Estimation without observations, Estimation given dependent observations, Orthogonality Principle, Spherically Invariant Gaussian Variables, Mean-Square Error Criterion, Minimization by Completion-of-Squares, Minimization of error covariance matrix, Optimal Liner Estimators, Channel Estimation, Block Data Estimation, Linear Channel Equalization, Multiple-Antenna Receivers	7
3.	Constrained Estimation	Minimum-Variance Unbiased Estimation, Mean Estimation, Channel and Noise Estimation, Decision Feedback Equalization, Antenna Beamforming, Recursion for the state Estimator, Riccati Recursion, Measurement and Time-Update Form	8
4.	Stochastic Gradient Algorithms	Principle and Application, Steepest Descent Algorithm, Applications of Adaptive filters, Modes of convergence, Optimal Step size, Weight error vector convergence, Learning curve, contour curves of the Error surface, Iteration-Dependent Step-size, Newton's method	8
5.	LMS Algorithm	Instantaneous Approximation, Computational cost, Least-perturbation property, Applications: Adaptive Channel	6

		Estimation and adaptive Channel Equalization, Decision-Feedback Equalization, Ensemble –Average Learning Curves	
6.	Least-Squares methods	Least-Squares Problem, Properties and Projection Matrices, Weighted Least-Squares, Regularized Least-Squares, Weighted Regularized Least-Squares, RLS Algorithm, Regularization,	6
Total number of Lectures			40

Evaluation Criteria	
Components	Maximum Marks
T1	20
T2	20
End Semester Examination	35
TA	25 (5 Assignment, 5 Quiz, 5 Class Participation, 10 Attendance)
Total	100

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)	
1.	Adaptive Filters by Ali H Sayed
2.	Symon Haikin Adaptive Filters

Detailed Syllabus
Lecture-wise Breakup

Course Code	18B12HS815	Semester Even	Semester 8th Session 2018 -2019 Month from January 2019 to May 2019
Course Name	QUALITY ISSUES IN ENGINEERING		
Credits	3	Contact Hours	3-0-0

Faculty (Names)	Coordinator(s)	Dr. Santoshi Sengupta
	Teacher(s) (Alphabetically)	Dr. Santoshi Sengupta

COURSE OUTCOMES		COGNITIVE LEVELS
C402-32.1	Apply the concepts of quality within quality management systems by understanding various perspectives, historical evolution; and contributions of key gurus in the field of quality	Apply Level (C3)
C402-32.2	Determine the effectiveness of acceptance sampling using single and double sampling plans and operating characteristic curves	Evaluate Level (C5)
C402-32.3	Determine quality by employing a wide range of basic quality tools, lean concepts and process improvement techniques such quality function deployment	Evaluate Level (C5)
C402-32.4	Examine the importance of six sigma, various quality standards, awards, certifications	Analyze Level (C4)

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Fundamentals of Quality	Perspectives and Definitions of Quality, Dimensions Of Quality for Product and Service, History of Quality, Phases of Quality Assurance, Alignment, Linkage, Reengineering, Contribution of Gurus – Shewhart, Deming, Ishikawa, Juran	6
2.	Cost of Quality and Quality Function Deployment	Cost of Quality, Voice Of Customers: Kano's Model, House Of Quality, QFD Process	6
3.	Basic Tools of Quality	Checksheets, Cause and Effect Diagrams, Histograms, Flowcharts, Pareto Analysis, Scatter Diagrams, Run Charts	9
4.	Statistical Thinking And Applications	Acceptance Sampling, Single Sampling Plan, Double Sampling Plan, Statistical Process Control, Specification And Control Limits, Control Charts For Attributes, Control Charts For Variables	9
5.	Six Sigma, Benchmarking and Lean Concepts	Six Sigma, Capability Of A Process/Product/Service, DMAIC Process, Benchmarking Meaning, Process, Methods; JIT, Andon, Kanban, Kaizen, Poka-Yoke, 5-S, 7 Mudass	9
6.	Quality Standards	ISO Standards, MBNQA, RGNQA, Deming Prize	3

	and Awards		
Total number of Lectures			42
Evaluation Criteria			
Components	Maximum Marks		
T1	20		
T2	20		
End Semester Examination	35		
TA	25 (Project, Assignment, Case Study, Quiz, Oral Questions)		
Total	100		

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)	
1.	NVS Raju, Total Quality Management, 1 st Edition, Cengage Learning, 2014
2.	Kanishka Bedi, Quality Management, 1 st Edition, Oxford University Press, 2006
3.	D.H. Besterfield, Total Quality Management, Revised 3 rd Edition, Pearson Education, 2011

Detailed Syllabus
Lecture-wise Breakup

Course Code	18B12BT415	Semester Even (specify Odd/Even)	Semester VIII Session 2018 -2019 Month from January-June
Course Name	Intellectual Property Rights and Bioethics		
Credits	3	Contact Hours	3

Faculty (Names)	Coordinator(s)	1. Prof. S Krishna Sundari
	Teacher(s) (Alphabetically)	1. Prof. S Krishna Sundari

COURSE OUTCOMES		COGNITIVE LEVELS
C402-14.1	Recall National and International IP rules and Agreements	Remember Level(C1)
C402-14.2	Summarize various aspects of Intellectual Property Rights in context with technological advancements	Understand Level(C2)
C402-14.3	Utilize different patent search engines and search patent literature in speciality domains	Apply Level(C3)
C402-14.4	Identify appropriate guidelines related to engineering, professional, and biotechnology research ethics	Apply Level(C3)
C402-14.5	Survey and classify patents, make a report and present the IPR status in different fields.	Analyze Level(C4)

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Intellectual Property Rights	Different forms of Intellectual Property Rights - their Relevance, Importance to Industry, Academia, Role of IPRs in biotechnology, Patent Terminology: Patents, Trademarks, Copyrights, Industrial Designs, Geographical Indications, Trade secrets, non-disclosure agreements, Patent Life and Geographical Boundaries	4
2.	International organizations & IPR	Overview of WTO, TRIPS, WIPO, GATT, International conventions, Trade agreements, Implication of TRIPS for developing countries	3
3.	Process involved in Patenting, Patent Search	Procedural steps in patenting, Process of filing, PCT application, pre-grant & post-grant opposition, PCT and Patent harmonization including Sui-generis system, Patent Search methods, Patent Databases & Libraries, online tools, Country-wise patent searches (USPTO, EPO, India etc.), patent mapping	4
4.	IPR in Agriculture Technology & Biotechnology	Basic features of Indian Plant Varieties Protection & Farmer's Rights Act, UPOV, Invention/ Discovery, Patentable subject matter, Generics, Compulsory Licensing, Exclusive Marketing Rights (EMR), Bolar provision, Bayh-Dole act, Second medical use	4

5.	Traditional Knowledge and Intellectual Property Rights	The importance of Traditional Knowledge (TK) for developing nations, protecting TK, The local, national and global dimensions of the issues in TK and IPRs, Traditional Medicine & IP Protection, Folklore, Patenting of Health Foods: Case studies	3
6.	Introduction to Bioethics	Need of bioethics, applications and issues related to Bioethics, Social and cultural issues	2
7.	Bioethics & Biodiversity	Conserving natural Biodiversity, convention on protecting Biodiversity, Protocols in exchanging Biological material across borders	2
8.	Bioethics & GMO's	Issues and concerns pertaining to Genetically modified foods & food crops, Organisms and their possible health implications and mixing up with the gene-pool	3
9.	Bioethics in Medicine	Protocols of ethical concerns related to prenatal diagnosis, gene therapy, Organ transplantation, Xenotransplantation, ethics in patient care, Informed consent	7
10.	Bioethics & Cloning	Permissions and Procedures in Animal Cloning, Human cloning, Risks and hopes	3
11.	Bioethics in Research	Stem cell research, Human Genome Project, Use of animals in research, human volunteers for Clinical research, Studies on Ethnic races	5
12.	Ethics in Profession	Ethics related to professional streams , engineering	2
Total number of Lectures			42

Evaluation Criteria

Components	Maximum Marks
T1	20
T2	20
End Semester Examination	35
TA	25 (Assignments, Attendance)
Total	100

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

1.	“Bioethics & Biosafety” by Sateesh MK, IK International publications, 2008
2.	USPTO Web Patent Databases at: www.uspto.gov/patft
3.	Government of India's Patents Website: patinfo.nic.in
4.	Intellectual property India: www.ipindia.nic.in
5.	“Indian Patent Law : Legal and Business Implications” by AjitParulekar, Sarita D'Souza Macmillan India publication, 2006
6.	“Agriculture and Intellectual Property Rights”, edited by: Santaniello,V., Evenson, R.E., Zilberman, D. and Carlson, G.A. University Press publication, 2003
7.	Research papers and Reports provided from time to time

Detailed Syllabus

Lecture-wise Breakup

Course Code	16B1NMA831	Semester Even (specify Odd/Even)	Semester VIII Session 2018-2019 Month from January 2019 to June 2019
Course Name	Optimization Techniques		
Credits	3	Contact Hours	3-0-0
Faculty (Names)	Coordinator(s)	Prof. A. K. Aggarwal	
	Teacher(s) (Alphabetically)	Prof. A. K. Aggarwal	
COURSE OUTCOMES			COGNITIVE LEVELS
After pursuing the above mentioned course, the students will be able to:			
C402-2.1	apply generalized, revised and dual simplex method for linear programming problems (LPP).	Applying Level (C3)	
C402-2.2	apply graphical, algebraic and linear programming techniques for pure and mixed strategy problems in game theory.	Applying Level (C3)	
C402-2.3	classify and solve the problems on queuing and inventory models.	Analyzing Level (C4)	
C402-2.4	solve and analyze the network scheduling and sequencing problems.	Analyzing Level (C4)	
C402-2.5	make use of dynamic programming technique to solve complex linear programming problems.	Applying Level (C3)	
C402-2.6	determine numerical solution of nonlinear multidimensional problems.	Evaluating Level (C5)	
Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Review of Linear Programming	Convex sets, Linear Programming Problems (LPP), graphical and simplex method, Big-M method, Two phase method, generalized simplex method, revised simplex method, Duality theory, dual simplex method.	08
2.	Game Theory	Rectangular Games, Minmax Theorem, Graphical Solution of $2 \times n$, $3 \times n$, $m \times 2$, $m \times 3$ and $m \times n$ Games, Reduction to Linear Programming Problems.	06
3.	Queuing Theory & Inventory Model:	Introduction, Steady-State Solutions of Markovian Queuing Models: M/M/1, M/M/1 with limited waiting space, M/M/C, M/M/C with limited space, M/G/1, Inventory Models.	06
4.	Sequencing & Scheduling	Processing of Jobs through Machines, CPM and PERT.	06
5.	Dynamic Programming	Discrete and Continuous Dynamic Programming, Simple Illustrations.	06

6.	Nonlinear Programming	Unimodal function, One Dimensional minimization problem, Newton's Method Golden Section, Fibonacci Search, Bisection, Steepest Descent Method, Multidimensional Newton's method.	08
		Total number of Lectures	40
Evaluation Criteria			
Components		Maximum Marks	
T1		20	
T2		20	
End Semester Examination		35	
TA		25 (Quiz, Assignments)	
Total		100	
Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)			
1.	Taha H. A., Operations Research: An Introduction, 7th edition, PHI, 2002.		
2.	Rao, S. S. - Engineering Optimization, Theory and Practice, Third Edition, New Age International Publishers, 2010.		
3.	Wagner, H. M., Principles of Operations Research with Applications to Managerial Decisions, Prentice Hall of India Pvt. Ltd., 1975.		
4.	Hillier F. and Lieberman G. J., Introduction to Operations Research, 6th edition, McGraw-Hill, 1995.		

Detailed Syllabus
Lecture-wise Breakup

Course Code	19B1NHS812	Semester- Even	Semester 8th Session 2018 -2019 Month from January 2019 to June 2019
Course Name	International Finance		
Credits	3	Contact Hours	3-0-0

Faculty (Names)	Coordinator(s)	Dr. Mukta Mani
	Teacher(s) (Alphabetically)	Dr. Mukta Mani

COURSE OUTCOMES		COGNITIVE LEVELS
C402-12.1	Explain the global market scenario, its imperfections and risks which affect the multinational businesses trade.	Understanding level (C2)
C402-12.2	Analyze the international transactions of balance of payments and understand their relationship with key macroeconomic indicators	Analyzing level (C4)
C402-12.3	Apply the concepts of foreign exchange market and currency derivatives for making transactions in foreign exchange market	Applying level (C3)
C402-12.4	Analyze the role of parity conditions and other factors in exchange rate determination.	Analyzing level (C4)
C402-12.5	Analyze the central bank's intervention in foreign exchange market and evaluate the causes of exchange rate disequilibrium	Evaluating level (C5)

Module No.	Subtitle of the Module	Topics in the module	No. of Lectures for the module
1.	Introduction	Financial Globalization and Risk, Global financial Marketplace, Eurocurrency market and LIBOR, Theory of comparative advantage, Globalization process	4
2.	Balance of Payments	BOP transactions, accounting, Accounts of BOP, Capital and Financial Accounts, BOP and key macroeconomic variables	4
3.	Exchange Rates	Foreign Exchange market, functions, participants, types of transactions: spot, forward and swap transactions Methods of stating exchange rates, quotations and changes in exchange rates	6
4.	Foreign Exchange rate determination and forecasting	Exchange rate determination theories, Currency market intervention, disequilibrium, forecasting	6
5.	Forward Exchange	Forward foreign exchange, premiums and discounts, forward rates vs future spot rates, payoff profile, swaps, forward quotations	6
6.	Currency Futures and options market	Foreign currency futures, Currency options, Forwards, futures and options compared	6

7.	International Parity Conditions	Purchasing Power Parity and Interest Parity Prices and Exchange rates, Exchange rate pass-through, Forward rate, Prices, Interest rates and exchange rates in equilibrium	5
8.	Transaction and Translation Exposure	Types of foreign exchange exposure, Hedging, Overview of translation, Translation methods, US translation procedures	5
Total			42

Evaluation Criteria

Components

Maximum Marks

T1	20
T2	20
End Semester Examination	35
TA	25 (Class test, Assignment, Class participation)
Total	100

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

1.	Eiteman, D K., Stonehill, A.I. and Moffett, M.H., <i>Multinational Business Finance</i> , 14 th Ed., Pearson India Education, 2018.
2.	Levi, M.D., <i>International Finance</i> , 4 th Ed., Routledge Publication, 2009.
3.	Jain, P K., Peyrard, J. and Yadav, S.S., <i>International Financial Management</i> , Macmillan India, 1999.
4.	Desai, M.A., <i>International Finance- A Casebook</i> , Wiley India, 2007.
5.	Shapiro, Alan C., <i>Multinational Financial Management</i> , 7 th Ed., John Wiley and Sons Inc., 2003.

Detailed Syllabus
Lecture-wise Breakup

Course Code	18B12NHS812	Semester Even (specify Odd/Even)	Semester 8 Session 2018 -2019 Month from Jan 2018 to July 2018
Course Name	Social and Legal Issues		
Credits	3	Contact Hours	3-0-0

Faculty (Names)	Coordinator(s)	Dr Swati Sharma
	Teacher(s) (Alphabetically)	Dr Swati Sharma

CO Code	COURSE OUTCOMES	COGNITIVE LEVELS
C402-10.1	Demonstrate an understanding of social science and business law to individuals and businesses.	Understanding Level (C2)
C402-10.2	Critically evaluate how information technology, contractual agreements, rights and obligations affects business and society	Evaluating Level (C5)
C402-10.3	Analyse legal implications of societal laws.	Analyzing Level (C4)
C402-10.4	Develop acceptable attitudes with respect to ethical cultural and social issues related to technology, system, information	Applying Level (C3)

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Introduction	Introduction to Social and Legal Issues	1
2.	Social Structure and Impact	Social Structure Social Impact on Information system and Technology Corporate Social Responsibility	6
3.	Ethics	Business Ethics & Values, Professional Conduct, Code of ethics for an Engineer, Ethics in Bio-Tech.	6
4.	Societal Laws	Introduction to Constitution, Right to information, Consumer Protection Act,	8
5.	Business Laws	Contract Act, Company Act, Negotiable Instruments Acts	8
6.	Intellectual Property & Cyberspace	Intellectual Property Issues:(What is Intellectual Property , Copyright Law, Trademark and Law of Patent	5
7.	Cyber Crime, Laws and IT Act	Computer Crimes(Fraud and Embezzlement, Sabotage & Information Theft, Intruders, Hacking& Cracking), Computer Crime Laws, Digital Forgery, Cyber Terrorism, Wiretapping, IT Act	8
Total number of Lectures			42

Evaluation Criteria	
Components	Maximum Marks
T1	20
T2	20
End Semester Examination	35

TA	25 (Assignment and Oral Viva)
Total	100

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)	
1.	Albuquerque D, Business Ethics Principles and Practices, 1 st edition, Oxford University Press,2010
2.	Baase,S, A Gift Of Fire Social, Legal, & Ethical Issues in Computing and Internet,2 nd edition Prentice Hall, US, 2006
3.	Diwan,P. & Kapoor,S, Cyber And E-Commerce Laws with information Technology Act, & Rules,2 nd edition, Prakesh Publication House,Jaipur , 2000
4	Gogna,P.P.S., A Text book of Business Law, 1 st ed, , S Chand & Company LTD.2000
5	Ghosh,B., Ethics in Management and Indian Ethos, 2 nd Edition, Vikas Publishing house,New Delhi, 2006

Detailed Syllabus
Lecture-wise Breakup

Course Code	18B12PH811	Semester Even	Semester VIII Session 2018 -2019 Month from January to June
Course Name	Photonics and Applications		
Credits	3	Contact Hours	3

Faculty (Names)	Coordinator(s)	Navneet Kumar Sharma and Anshu Varshney
	Teacher(s) (Alphabetically)	Navneet Kumar Sharma and Anshu Varshney

COURSE OUTCOMES		COGNITIVE LEVELS
C402-3.1	Recall the fundamental properties of light and the processes involved in the generation of light	Remembering (C1)
C402-3.2	Interpret the theory of fiber optics	Understanding (C2)
C402-3.3	Apply the fundamentals of various nonlinear optical effects in technology; make use of holography and its applications	Applying (C3)
C402-3.4	Compare the operational principles, characteristics and trade-offs of optical detectors and modulators of light	Analyzing (C4)

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Lasers	Review of different types of laser systems. LEDs, Semiconductor lasers, Quantum well lasers, Q-switching and Mode locking in lasers.	8
2.	Fiber Optics	Numerical aperture, Step and graded index multimode fibers, attenuation and dispersion, modes in optical fibers. Single mode fiber, mode cutoff and mode field diameter. Connector and splice losses, Erbium doped fiber amplifier and Characterization techniques including OTDR.	10
3.	Photo detectors	Semiconductor photo detectors.	5
4.	Optical Electronics	Wave propagation in anisotropic media, Electro-optic effect: phase and amplitude modulation. Acousto-optic effect: modulators, deflectors and tunable filters, Magneto-optic effect: modulators.	4
5.	Optical devices	Electro-optical device, Acousto-optical device, Magneto-optical device, Optical Communication.	2
6.	Nonlinear Optics	SHG, Sum and Difference frequency generation, parametric amplification, wavelength converters, Self focusing with lasers.	6
7.	Holography	Recording and Reproduction of Hologram, Applications of holography.	4
8.	Applications of Photons in Memory devices	CD, VCD, DVD.	1
Total number of Lectures			40

Evaluation Criteria

Components	Maximum Marks
T1	20
T2	20
End Semester Examination	35
TA	25 [2 Quiz (10 M), Attendance (10 M) and Cass performance (5 M)]
Total	100

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

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| 1. | R. P. Khare, <i>Fiber Optics and Optoelectronics</i> , Oxford University Press. |
| 2. | A. K. Ghatak and K. Thyagarajan, <i>Optical Electronics</i> , Cambridge university Press. |
| 3. | A. K. Ghatak and K. Thyagarajan, <i>An Introduction to Fiber Optics</i> , Cambridge university Press. |
| 4. | B. B. Laud, <i>Lasers and Nonlinear Optics</i> , New Age International. |

Detailed Syllabus
Lecture-wise Breakup

Course Code	18B12PH812	Semester: Even	Semester: VIII Session : 2018 -2019 Month from: January to June
Course Name	Astrophysics		
Credits	3	Contact Hours	3

Faculty (Names)	Coordinator(s)	Prof.Anirban Pathak and Dr. Sandeep Chhoker
	Teacher(s) (Alphabetically)	Anirban Pathak and Sandeep Chokker

COURSE OUTCOMES		COGNITIVE LEVELS
C402-4.1	Relate historical development of astrophysics with the modern concepts and recall the mathematical techniques used & definition of different units	Remembering (C1)
C402-4.2	Explain the models of universe, ideas of stellar astrophysics, life cycles of stars, physical principles that rules galaxies, and general theory of relativity	Understanding (C2)
C402-4.3	Apply mathematical principles and laws of physics to solve problems related to astrophysical systems	Applying (C3)
C402-4.4	Compare different models of universe and decide which one is logically acceptable and why	Analyzing (C4)

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1	Introduction to Astrophysics	Historical development of astrophysics (from mythology to contemporary astrophysics), Mass, length and time scales in astrophysics, sources of astronomical information (effect of discovery of spectroscopes and photography), astronomy in different bands of electromagnetic radiation (e.g. Optical astronomy, infra-red astronomy radio astronomy, X-ray astronomy. Gamma-ray astronomy etc. with specific mention of Hubble space telescope). Kirchoff's law, Doppler effect and Hubble's law.	8
2.	Stellar Astrophysics	Classification and nomenclature of stars. Basic equations of stellar structure, main sequence, red giants and white dwarfs, HR diagram, stellar evolution, supernovae, extra solar planets.	8
3.	Death of a star	End states of stellar collapse: degeneracy pressure of a Fermi gas, structure of white dwarfs, Chandrasekhar mass limit, neutron stars pulsars and black holes.	6
4.	Our galaxy	The shape and size of Milky way and its interstellar mater	2
5.	Extragalactic astrophysics	Normal galaxies, active galaxies, cluster of galaxies, large-scale distribution of galaxies.	6
6.	GTR and Models of Universe	Qualitative idea of general theory of relativity (without using tensor calculus) and its implications. Different models of universe. Specific attention to the ideas	6

		related to big bang, cosmological constants, dark matter and dark energy.	
7.	Astrobiology	Drake equation and related questions.	2
8.	Conclusion	Review of the present status of Astrophysics and open questions.	2
Total number of Lectures			40
Evaluation Criteria			
Components		Maximum Marks	
T1		20	
T2		20	
End Semester Examination		35	
TA		25 [2 Quizes (10 M), Attendance (10 M) and Class performance (5 M)]	
Total		100	

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)	
1.	Astrophysics for Physicists, Arnab Rai Choudhuri, Cambridge University Press, Delhi, 2010.
2.	Astrophysics: Stars and Galaxies, K D Abhyankar, University Press, Hyderabad, 2009.
3.	Facts and Speculations in Cosmology, J V Narlikar and G Burbidge, Cambridge University Press, Delhi, 2009.
4.	The Cosmic Century, Malcolm Longair, Cambridge University Press, Cambridge, 2006.
5.	An Introduction to Astrophysics, Baidyanath Basu, Prentice Hall of India, Delhi 1997.
6.	Fundamentals of Equations of State, S. Eliezer, A Ghatak and Heinrich Hora, World Scientific, Singapore, 2002. Only Chapter 15.

Detailed Syllabus
Lab-wise Breakup

Course Code	15B19EC891	Semester Even (specify Odd/Even)	Semester 8th Session 2018 -2019 Month from January to May
Course Name	Major Project Part-2		
Credits	12	Contact Hours	

Faculty (Names)	Coordinator(s)	Dr. Sajai Vir Singh
	Teacher(s) (Alphabetically)	Mr. Varun Goel

COURSE OUTCOMES		COGNITIVE LEVELS
CO1	Summarize the contemporary scholarly literature, activities, and explored tools/ techniques/software/hardware for hands-on in the respective project area in various domain of Electronics Engineering.	Understanding (Level II)
CO2	Analyze/ Design the skill for obtaining the optimum solution to the formulated problem with in stipulated time	Analyzing (Level IV)
CO3	Evaluate /Validate sound conclusions based on evidence and analysis	Evaluating (Level V)
CO4	Develop the skill in student so that they can communicate effectively in both verbal and written form.	Create Level (Level VI)

Evaluation Criteria	
Components	Maximum Marks
Mid Term Viva (V1)	20
End Term Viva (V2)	30
Day to Day	30
Project Report	20
Total	100

Detailed Syllabus
Lecture-wise Breakup

Course Code	17M21EC114	Semester EVEN (specify Odd/Even)	Semester II (M.Tech.) & VIII (INTG.) Session 2019 -2020 Month from: January to June
Course Name	Advanced Embedded System		
Credits	4	Contact Hours	3L

Faculty (Names)	Coordinator(s)	Dr. Gaurav Verma (62)
	Teacher(s) (Alphabetically)	

COURSE OUTCOMES		COGNITIVE LEVELS
CO1	Understanding of the fundamental concepts of ARM7 processor and detailed study of complete architecture of the ARM7 based LPC2148 microcontroller.	Applying Level (C3)
CO2	Understanding and detailed study of the complete architecture of the ARM-CORTEX processor and STM32 (ARM-CORTEX based microcontroller).	Understanding Level (C2)
CO3	Experiment the basic concepts of embedded ‘C’ programming to program on chip and external peripherals with STM32 microcontroller around various sensors and actuators.	Analyzing Level (C4)
CO4	Understanding of the basic concept of Linux Operating system and Linux system programming using ‘C’	Understanding Level (C2)

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	ARM7TDMI Architecture & On Chip Peripherals (LPC2148)	Review of ARM architecture, System Peripherals, Memory Accelerated Module (MAM), Phase Locked Loop (PLL), Power Control, APB (ARM Peripheral Bus) Divider, Wake up Timer, Brown out detection, Pin Connect Block, Interrupt System, Vectored Interrupt Controller (VIC), User Peripherals, General Purpose Input/ Output (GPIO), Timer/Counter, Pulse Width Modulation (PWM), Real Time Clock (RTC), Watch Dog Timer (WDT), ADC & DAC, On Chip Communication Interface, Universal Asynchronous Receiver Transmitter (UART), Inter Integrated Communication (I2C), Serial Peripheral Interface (SPI).	12
2.	ARM CORTEX Processor (M3) and Controller (STM32)	ARM Architectural Revision, Cortex Processor And Cortex CPU, Cortex CPU Pipeline, Programmer’s Model CPU Operating Modes, Thumb-2 Instruction Set, Memory Map, Unaligned Memory Accesses, Bit Banding Cortex Processor Busses, Bus Matrix, System Timer, Interrupt Handling, Nested Vector Interrupt Controller, STM32 Family, Package Types & Portfolio, Features of STM32F100RB, STM32 Architecture& pin description, Hardware Considerations,	12

		Memory map & bus structure, External Oscillators, Clock control and Internal Oscillators.	
3.	On chip peripherals of STM32F100RB	Reset and Clock Control Group, Phase Locked Loop (PLL), APB1 and APB2 (ARM peripheral Bus) divider, GPIOs & AFIOs (General purpose input output), Timer/Counter (Basic and General Purpose), Capture and Compare mode of Timers, PWM (Pulse Width modulation), DMA (Direct Memory Access, Interfacing with sensors and actuators	10
4.	Linux Basics & System Programming	Linux Basics, Introduction to Linux, Reasons for its popularity, Linux file system, Linux Distributions, Linux Commands, Operating System architecture and concepts, Kernel classification (Monolith kernel and Microkernel), Linux System Programming, Working with files (high & low level file handling).	8
Total number of Lectures			42

Evaluation Criteria

Components	Maximum Marks
T1	20
T2	20
End Semester Examination	35
TA	25 (Assignments and Quiz)
Total	100

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

1.	http://www.hitex.com/fileadmin/pdf/insiders.../stm32/isg-stm32-v18d-scr.pdf .
2.	http://www.hitex.com/fileadmin/pdf/insiders-guides/lpc/lpc-arm-book_rev10-screen.pdf
3.	Neil Matthew / Richard Stones, “Beginning Linux Programming”, Wrox India, 2002.
4.	Robert Love, “Device Drivers”, 1 st Edition, O’Reilly, 2010.

Detailed Syllabus
Lecture-wise Breakup

Course Code	17M21EC115	Semester : Even (specify Odd/Even)	Semester VIII/II Session 2018 -2019 Month from Jan to May
Course Name	Analogue Integrated Circuit Design		
Credits	3	Contact Hours	3

Faculty (Names)	Coordinator(s)	Dr Garima Kapur
	Teacher(s) (Alphabetically)	Nil

COURSE OUTCOMES		COGNITIVE LEVELS
CO1	To remember and understand prerequisite topics like MOS physics and circuits.	Understanding (Level II)
CO2	To analyze noise and applying various feedback topologies removing it.	Analyzing (Level IV)
CO3	To classify and design Differential Amplifier	Analyzing (Level IV)
CO4	To Analyze Multistage Amplifier like Opamp. Design Voltage references	Evaluating (Level V)

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Basic MOS Physics, CMOS Technology	MOS IV Characteristics, Second order Effects, MOS Device Models, Introduction and Overview of IC technology, small signal models, Single stage Amplifiers - gain and bias considerations; Current Sources, Current mirrors, Cascade current mirrors; Frequency response of Amplifier – CS Amplifier, Miller effect	12
2.	Noise in Analog Circuits	Noise Characteristics, Thermal Noise, Flicker Noise, Representation of Noise in Circuits, Noise in Single Stage CS, CD, CG Amplifiers, Noise in Differential Pairs, Noise Bandwidth	08
3.	Feedback	Properties of Feedback Circuits, Feedback Topologies – Voltage-voltage, Current-voltage, Voltage-current, Current-current, Effect of Loading on Feedback Topologies,	06
4.	Differential Amplifiers	Single-ended and Differential Operation, basic Differential Amplifier pair – DC, AC and Transient Analysis, Common-Mode Response	04
5.	Operational Amplifier Design	Closed –loop stability of op-amp , Two stage opamp with miller compensation, differential and common mode half circuits, common mode feedback; Fully	06

		differential miller compensated opamp; Folded cascode Op-Amp design	
6.	Bandgap References	PTAT, CTAT, Bandgap References, Low power design techniques	04
Total number of Lectures			40

Evaluation Criteria

Components	Maximum Marks
T1	20
T2	20
End Semester Examination	35
TA	25 (15:Att+ 10:Assign.)
Total	100

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

1.	Behazd Razavi, “The Design of Analog CMOS Integrtaed Circuits”, 2 nd edition, McGrawHill, 2001
2.	Philip Allen, D. Holberg, “CMOS Analog Circuit Design”, 2 nd Edition, Oxford,
3.	Gray, Hurst, Lewis and Meyer, “Analysis & Design of Analog ICs”,4 th Wiley, 2001

Detailed Syllabus

Lecture-wise Breakup

Course Code	19M13HS111	Semester: Even (specify Odd/Even)	Semester: M.Tech & DD VIII Session: 2018 -2019 Month from: Jan-June
Course Name	English For Research Paper Writing		
Credits	2 (2-0-0)	Contact Hours	2
Faculty (Names)	Coordinator(s)	Dr Monali Bhattacharya	
	Teacher(s) (Alphabetically)	Dr Monali Bhattacharya	

COURSE OUTCOMES		COGNITIVE LEVELS
CO1	To understand the aspects of grammar and language needed to write a paper.	Understand Level (C2)
CO2	To have improved Writing Skills with proper grammar usage	Apply level (C3)
CO3	To have knowledge of what to write in each section of a paper after careful analysis of Literature Review	Analyze Level (C4)
CO4	To be adept in skills needed to write a title, abstract and introduction, methods, discussion, results and conclusion	Evaluate Level (C5)
CO5	To be capable of drafting a refined research paper after editing and proofreading	Create Level (C6)

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Grammar & Usage	Structure of English Language Voice &Tense SVOCA Sense & Sense Relations in English Enhancing Vocabulary Connotation, Denotation & Collocation	6
2.	Elements of Paper Writing	Planning & Preparation Word Order Breaking Long Sentences Structuring Paragraphs Being Concise and Removing Redundancy	6

3.	Paraphrasing & Writing	Highlighting Your Findings Paraphrasing and Plagiarism Sections of a Paper Abstracts; Introduction	4
4.	Process of Writing	Review of Literature Methods Results Discussion Conclusion	4
5.	Key Skills Needed	Key skills needed when writing a Title Key skills needed when Writing an Abstract Key skills needed when writing an Introduction Key skills needed when writing a Review of the Literature Key skills needed when writing Methods & Results Key skills needed when writing Discussion & Conclusion	4
6.	Refining the Paper	Incorporating useful phrases Editing Proofreading References Annexures Ensuring good quality in submission	4
Total number of Lectures			28
Evaluation Criteria			
Components		Maximum Marks	
Mid Term Examination		30	
End Semester Examination		40	
TA		30 (Assignments)	
Total		100	

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)	
1.	Goldbort R. 'Writing for Science', Yale University Press (available on Google Books), 2006
2.	Day R. 'How to Write and Publish a Scientific Paper', Cambridge University Press, 2006
3.	Adrian Wallwork. 'English for Writing Research Papers', Springer, New York, Dordrecht Heidelberg, London, 2011
4.	Yadugari M.A. ' Making Sense of English: A Textbook of Sounds, Words & Grammar' Viva Books Private Limited, New Delhi, 2013, Revised Edition
5.	Strauss, Jane. 'The Blue Book of Grammar and Punctuation, Josseybass, Wiley, San Francisco, 1999.