Himachal Pradesh Technical University, Hamirpur (H.P.)

CURRICULUM(CBCS)

ELECTRONICS AND COMMUNICATION ENGINEERING

(3rd to 8th Semester)

Teaching and Examination Scheme

Dean
H.P. Technical University
Hamirpur - 177001

SCHEME OF TEACHING AND EXAMINATION B.TECH-ELECTRONICS AND COMMUNICATION ENGINEERING										
SEMESTER – III										
S. N.	**Cat.**	**Course Code**	**Subject**	**Teaching Hours Per Weak**			**Credits**	**Examination**		
				L	**T**	**P/D**		**I.A Marks**	**ESE Marks**	**Total Marks**
1	FC	MA-301	Probability and Statistics	2	2	0	3	40	60	100
2	FC	HS – 305	Industrial Economics and Management	3	0	0	3	40	60	100
3	PC	EC-301	Analog Electronics	3	1	0	3	40	60	100
4	PC	EC-302	Digital Electronics	3	1	0	4	40	60	100
5	PC	EC-303	Network Analysis & Synthesis	3	1	0	3	40	60	100
6	PC	EC-304	Signals & Systems	3	1	0	4	40	60	100
7	OE	-	Open Elective-I	2	0	0	2	40	60	100
Labs:										
1	PC	EC-305	Analog Electronics Lab	0	0	2	1	30	20	50
2	PC	EC-306	Digital Electronics Lab	0	0	2	1	30	20	50
3	MC	EC-307	MATLAB & its application in signals & systems	0	0	3	2	30	20	50
			Total	**17**	**6**	**7**	**24+2**			

OPEN ELECTIVE I										
S. N.	**Cat.**	**Subject Code**	**Title**	**Teaching Hours Per Week**			**Credits**	**Examination**		
				L	**T**	**P/D**		**I.A Marks**	**ESE Marks**	**Total Marks**
1	HS	HS -306	Sociology & Elements of Indian History for Engineers	2	0	0	2	40	60	100
2	HS	HS -307	German Language - I	2	0	0	2	40	60	100
3	HS	HS-308	French Language – I	2	0	0	2	40	60	100

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SCHEME OF TEACHING AND EXAMINATION
B.TECH-ELECTRONICS AND COMMUNICATION ENGINEERING

SEMESTER – IV

S. N.	Cat.	Course Code	Subject	Teaching Hours Per Weak			Credits	Examination		
				L	T	P/D		I.A Marks	ESE Marks	Total Marks
1	FC	MA-401	Optimization and Calculus of Variations	2	2	0	3	40	60	100
2	FC	HS-409	Humans Values & Professional ethics	2	2	0	3	40	60	100
3	PC	EC-401	Analog Communication	3	1	0	4	40	60	100
4	PC	EC-402	Microprocessors & Peripherals	3	1	0	4	40	60	100
5	PC	EC-403	Linear Integrated Circuits	3	1	0	3	40	60	100
6	PC	EC-404	Pulse Shaping & Wave Generation	3	1	0	3	40	60	100
7	OE	-	Open Elective-II	2	0	0	2	40	60	100
Labs:										
1	PC	EC-405	Microprocessors& Peripherals Lab	0	0	2	1	30	20	50
2	PC	EC-406	Pulse Shaping, Wave Generation and LIC Lab	0	0	2	1	30	20	50
3	MC	EC-407	Electronic workshop& Analog Communication Lab	0	0	3	2	30	20	50
			Total	**16**	**8**	**7**	**24+2**			

OPEN ELECTIVE II

S. N.	Cat.	Subject Code	Title	Teaching Hours Per Week			Credits	Examination		
				L	T	P/D		I.A Marks	ESE Marks	Total Marks
1	HS	HS -410	Law for Engineers	2	0	0	2	40	60	100
2	HS	HS -411	German Language - II	2	0	0	2	40	60	100
3	HS	HS-412	French Language – II	2	0	0	2	40	60	100

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B.TECH-ELECTRONICS AND COMMUNICATION ENGINEERING

SEMESTER – V

S. N.	Cat.	Course Code	Subject	Teaching Hours Per Weak			Credits	Examination		
				L	T	P/D		I.A Marks	ESE Marks	Total Marks
1	PC	EC-501	Digital Communication	3	1	0	4	40	60	100
2	PC	EC-502	Electromagnetic Field Theory	3	1	0	4	40	60	100
3	PC	EC-503	Electronic logic circuit design	3	0	0	3	40	60	100
4	PC	EC-504	Electronic Measurements & Measuring Instruments	3	0	0	3	40	60	100
5	PC	EC-505	Power Electronics	2	2	0	3	40	60	100
6	PC	EC-506	Introduction to Microcontrollers for Embedded Systems	3	0	0	3	40	60	100
7	OE	-	Open Elective-III	2	0	0	2	40	60	100
Labs:										
1	PC	EC-511	Power Electronics & EMMI Lab	0	0	2	1	30	20	50
2	PC	EC-512	Introduction to Microcontrollers for Embedded systems lab	0	0	2	1	30	20	50
3	MC	EC-513	MATLAB and its application in communication systems	0	0	3	2	30	20	50
			Total	**18**	**6**	**7**	**24+2**			

OPEN ELECTIVE III (For Students of Other Departments)

S. N.	Cat.	Subject Code	Title	Teaching Hours Per Week			Credits	Examination		
				L	T	P/D		I.A Marks	ESE Marks	Total Marks
1	OE	EC-508	Biomedical Engineering	2	0	0	2	40	60	100
2	OE	EC-509	Microprocessor & Peripherals	2	0	0	2	40	60	100
3	OE	EC-510	Optical Communication	2	0	0	2	40	60	100

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SCHEME OF TEACHING AND EXAMINATION
B.TECH E&C ENGINEERING

SEMESTER – VI

S. N.	Cat.	Course Code	Subject	Teaching Hours Per Weak			Credits	Examination		
				L	T	P/D		I. A Marks	ESE Marks	Total Marks
1	PC	EC-601	Advanced Microcontrollers for Embedded systems	3	0	0	3	40	60	100
2	PC	EC-602	Antenna & Wave Propagation	3	0	0	3	40	60	100
3	PC	EC-603	Control Systems	3	1	0	4	40	60	100
3	PC	EC-604	Digital Signal Processing	3	1	0	4	40	60	100
5	PC	EC-605	Microelectronics Technology	2	2	0	3	40	60	100
6.	PC	EC-606	Wireless & Mobile Communication	3	0	0	3	40	60	100
7	PE	-	Programme Elective – I	3	0	0	3	40	60	100
Labs:										
1	PC	EC-611	Advanced Microcontrollers for Embedded systems Lab	0	0	2	1	30	20	50
2	PC	EC-612	Digital Signal Processing Lab	0	0	2	1	30	20	50
3	MC	EC-613	Seminar	0	0	2	1	50	50	100
			Total	**18**	**6**	**6**	**23+3**			

PROGRAM ELECTIVE-I

S. N.	Cat.	Subject Code	Title	Teaching Hours Per Week			Credits	Examination		
				L	T	P/D		IA Marks	ESE Marks	Total Marks
1	PE	EC-608	TV Engineering	3	0	0	3	40	60	100
2	PE	EC-609	Principles of Soft Computing	3	0	0	3	40	60	100
3	PE	EC-610	Reliability Engineering	3	0	0	3	40	60	100

Note: Industrial/Practical Trainingafter VIth Semester of **six weeks** duration.

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SEMESTER – VII

S. N.	Cat.	Course Code	Subject	Teaching Hours Per Weak			Credits	Examination		
				L	T	P/D		I. A Marks	ESE Marks	Total Marks
1	PC	EC-701	Computer Networks & Data Communication	3	0	0	3	40	60	100
2	PC	EC-702	Microwave & Radar Engineering	3	1	0	4	40	60	100
3	PC	EC-703	Optical Communication	3	0	0	3	40	60	100
4	PC	EC-704	VLSI Design	3	1	0	4	40	60	100
5	PE	-	Programme Elective – II	3	0	0	3	40	60	100
Labs:										
6	MC	EC-711	Project Work –I	0	0	4	2	50	50	100
7	PC	EC-712	Industrial /Practical Training Evaluation	0	0	0	2	50	50	100
8	MC	EC-713	Microwave & Optical Communication Lab	0	0	3	2	30	20	50
			Total	**15**	**3**	**11**	**20+3**			

PROGRAM ELECTIVE-II

S. N.	Cat.	Subject Code	Title	Teaching Hours Per Week			Credits	Examination		
				L	T	P/D		IA Marks	ESE Marks	Total Marks
1	PE	EC-708	Computer Architecture and Organization	3	0	0	3	40	60	100
2	PE	EC-709	Wireless Sensor Networks	3	0	0	3	40	60	100
3	PE	EC-710	Internet of Things (IoT)	3	0	0	3	40	60	100

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SCHEME OF TEACHING AND EXAMINATION
B.TECH-ELECTRONICS AND COMMUNICATION ENGINEERING

SEMESTER – VIII

S. N.	Cat.	Course Code	Subject	Teaching Hours Per Weak			Credits	Examination		
				L	T	P/D		I. A Marks	ESE Marks	Total Marks
1	PE	-	Program Elective – III	3	0	0	3	40	60	100
2	PE	-	Program Elective – IV	3	0	0	3	40	60	100
3	MC	EC-807	Project Work – II	0	0	16	8	50	50	100
			Total	**6**	**0**	**16**	**8+6**			
OR										
4	MC	EC-808	Industrial Project	0	0	16	8	50	50	100
			Total	**0**	**0**	**16**	**8**			

PROGRAM ELECTIVE-III

S. N.	Cat.	Subject Code	Title	Teaching Hours Per Week			Credits	Examination		
				L	T	P/D		IA Marks	ESE Marks	Total Marks
1	PE	EC -801	Biomedical Engineering	3	0	0	3	40	60	100
2	PE	EC -802	Information Theory & Coding	3	0	0	3	40	60	100
3	PE	EC -803	Digital System Design using HDL	3	0	0	3	40	60	100

PROGRAM ELECTIVE -IV

S. N.	Cat.	Subject Code	Title	Teaching Hours Per Week			Credits	Examination		
				L	T	P/D		IA Marks	ESE Marks	Total Marks
1	PE	EC -804	Digital Image Processing	3	0	0	3	40	60	100
2	PE	EC -805	Electronic Switching Systems	3	0	0	3	40	60	100
3	PE	EC -806	Satellite Communication	3	0	0	3	40	60	100

Note: Industrial Project of Four months duration is to be carried out by the student exclusively in industry under the joint supervision of faculty advisers from institution as well as from the industry.

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SEMESTER-III
MA 301: PROBABILITY AND STATISTICS

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
2	2	0	3	40	60	100	3 hrs

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**Probability and Random Variables:** Introduction,Basic concepts–Sample space, Events, Counting sample space, Conditional Probability and Independence, Permutations and Combinations, Rules of Probability,Bayes' Theorem. Random Variables – Concept of Random Variable, Percentiles, Probability Distributions – Discrete & Continuous, Mean, Variance and Covariance of Random Variables, Chebychev's inequality.	6
II	**Standard Probability Distributions:**Discrete distributions - Uniform,Binomial, Multinomial, Hyper geometric, Poisson, Negative Binomial, Poission; Continuous distributions - Normal, Exponential, Gamma, Weibull and Beta distributions and their properties -Function of Random variables.	6
III	**Sampling Distributions:**Random sampling, Sampling Distributions of Means, Estimation, Properties of point estimators, Confidence interval, Maximum likelihood and Bayes estimators, Prediction intervals.	6
IV	**Testing of Hypothesis:**Sampling distributions – testing of hypothesis for mean, variance, proportions and differences using Normal, t, Chi-square and F distributions, tests for independence of attributes and Goodness of fit. **Linear Correlation and Regression Analysis:**Introduction, Linear Regression model, Regression coefficient, Lines of correlation, Rank correlation	6

Text Books:

1. Gupta, S.C, and Kapur, J.N., ***"Fundamentals of Mathematical Statistics***", Sultan Chand, Ninth Edition, New Delhi,1996.
2. Johnson. R. A., ***"Miller & Freund's Probability and Statistics for Engineers",*** Sixth Edition, Pearson Education, Delhi, 2000.

3. Douglas C. Montgomery and George C. Runger, "***Applied Statistics and Probability for Engineers",*** 5th Edition, 2011.

Reference books:

1. Walpole, R. E., Myers, R. H. Myers R. S. L. and Ye. K, ***"Probability and Statistics for Engineers and Scientists",*** Seventh Edition, Pearson Education, Delhi, 2002.
2. Lipschutz. S and Schiller. J, ***"Schaum's outlines - Introduction to Probability and Statistics"***, McGraw-Hill, New Delhi, 1998.
3. S. M. Ross, "***Introduction to Probability and Statistics for Engineers and Scientists***" 4th edition.

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HS 305: INDUSTRIAL ECONOMICS AND MANAGEMENT

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
3	0	0	3	40	60	100	3 hrs

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**Introduction to Engineering Economics** - Technical efficiency, economic efficiency - cost concepts:elements of costs, opportunity cost, sunk cost, private and social cost, marginal cost, marginal revenue and profit maximization. **Supply and Demand:**Determinants of demand, law of demand, determinants of supply, law of supply,market equilibrium - elasticity of demand - types of elasticity, factors affecting the price elasticity of demand **National Income Concepts:** GDP and GNP, per capita income, methods of measuring national income. Inflation and deflation:	**8**
II	**Value Analysis** - Time value of money - interest formulae and their applications: single-payment compound amount factor, single-payment present worth factor, equal-payment series compound amount factor, equal-payment series sinking fund factor, equal-payment series present worth factor,equal-payment series capital recovery factor, effective interest rate. **Investment Analysis:** Payback period—average annual rate of return, net present value; Internal rate of return criteria,price changes, risk and uncertainty.	**8**
III	**Principles of Management:** Evolution of management theory and functions of management organizational structure - principle and types - decision making - strategic, tactical &operational decisions, decision making under certainty, risk & uncertainty and multistage decisions & decision tree. **Human Resource Management:** Basic concepts of job analysis, job evaluation, merit rating, wages,incentives, recruitment, training and industrial relations.	**8**
IV	**Financial Management**: Time value of money and comparison of alternative methods; costing – elements& components of cost, allocation of overheads, preparation of cost sheet,break even analysis - basics of accounting - principles of	**8**

	accounting, basic concepts of journal, ledger, trade, profit&loss account and balance sheet. **Marketing Management:** Basic concepts of marketing environment, marketing mix, advertising and sales promotion. **Project Management:** Phases,organization, planning, estimating, planning using PERT & CPM.	

Text Books:

1. PanneerSelvam, R, **"*Engineering Economics***", Prentice Hall of India Ltd, New Delhi.
2. Dwivedi, D.N**.,** **"*Managerial Economics**, 7/E"*, Vikas Publishing House.

Reference Books:

1. Sullivan, W.G, Wicks, M.W., and Koelling. C.P., **"*Engg. Economy 15/E*"**,Prentice Hall, New York, 2011.
2. Chan S. Park, **"*Contemporary Engineering Economics***", Prentice Hall of India, 2002.
3. F. Mazda, ***Engg.Management***, Addison Wesley, Longman Ltd., 1998.
4. O. P. Khanna***, Industrial Engg.and Management,***DhanpatRai and Sons, Delhi, 2003.
5. P. Kotler, ***Marketing Management, Analysis, Planning, Implementation and Control***,Prentice Hall, New Jersey, 2001.
6. VenkataRatnam C.S &Srivastva B.K,***Personnel Management and Human Resources,*** Tata McGraw Hill.
7. Prasanna Chandra, ***Financial Management****: Theory and Practice*, Tata McGraw Hill.
8. Bhattacharya A.K., ***Principles and Practice of Cost Accounting***, Wheeler Publishing.
9. Weist and Levy, ***A Management guide to PERT and CPM***, Prantice Hall of India.
10. Koontz H.,O'Donnel C.,&Weihrich H, ***Essentials of Management***, McGraw Hill.

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EC-301: ANALOG ELECTRONICS

Teaching Scheme			Credits	Marks			Duration End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
3	1	0	3	40	60	100	3 hrs

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**Semiconductor diodes:** Diode specifications, Diode resistance, Diode junction capacitance, Diode equivalent circuits, Load line analysis of diode circuit, Diode types: Zener, Backward, Varactor, Step recovery, Schottky, Tunnel. **Low frequencyBJT analysis:** Simplified & complete h-parameter analysis for CB, CE and CC & configuration, Calculation of CB, CE & CC parameters using h-parameters.	7
II	**Multistage amplifier:** General cascaded system, RC coupled amplifier and its frequency response, Merits and demerits, Transformer coupled amplifier,Cascode amplifiers, Darlington pair amplifiers, Effect of frequency on multistage amplifier stages. **High frequency analysis of BJT:** High frequency model for CE amplifiers, Approximate CE high frequency model with resistive load, CE short circuit gain.HF current gain with resistive load.	8
III	**Large signal amplifiers:** Analysis and design of Class A, B, AB amplifiers; Class A, B, AB Push Pull amplifiers, Merits & demerits, Distortion calculations. **Tuned amplifiers:** General behaviour of tuned amplifiers, Advantages and disadvantages of tuned amplifiers. Single tuned amplifiers, Frequency response of single tuned amplifiers,Staggered tuned amplifier.	8
IV	**Feedback amplifiers:** Introduction, Characteristics of negative feedback, Feedback topologies: Voltage series, Voltage shunt, Current series and Current shunt. **Optoelectronic devices** Photo sensors, Photo conductor, Photodiodes, Photo transistor, LED, LCD,	7

	OLEDs, Plasma display, Field emission displays, Electronic ink displays, Opto-couplers.	

Text Books

1. ***Electronic Devices & Circuits,*** A.K.Maini, Wiley.
2. ***Basic Electronics and Linear Circuits***, N.N. Bhargava, S.C.Gupta, D.C.Krlshreshtha, TMH
3. ***Electronic Devices & Circuit Theory***,Boylestad, Pearson

Reference Books

1. ***Electronic Devices & Circuits***, I.J.Nagrath, PHI.
2. ***Electronic Devices & Circuits***,Salivahnan, TMH.
3. ***Fundamental of Electronics***, Thomas, Morgan & Claypool Publishers.

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EC-302: DIGITAL ELECTRONICS

Teaching Scheme			Credits	Marks			Duration End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
3	1	0	4	40	60	100	3 hrs

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**Number system & codes:** Binary arithmetic (Addition, Subtraction, Multiplication andDivision),Floatingpoint numbers.Diminished radix and radix compliments, BCD codes, 8421 code,Excess-3 code, Gray code, Error detection and correction: Parity code, Hamming code. **Logic gates:** Positive & negative logic, Tristate logic gates, Schmitt gates, Totem pole output and open collector output;Fan in and Fan out of logic gates, Buffer & trans-receivers, IEEE/ANSI standards symbols.	**8**
II	**Boolean algebra simplification techniques:** Sum of products and product of sums simplification, NAND and NOR implementation, Incompletely specified functions, Ex-OR functions, The map method: Two, Three, Four and Fivevariable maps;The tabulation method, Determination of prime implicants, Selection of essentialprime implicants. **Logic families:** Classification of digital IC's, Significance & types, Characteristics parameters, TTL, ECL, CMOS logic families, NMOS & PMOS logic,interfacing between TTL & CMOS.	**9**
III	**Combinational logic circuits:** Implementing combinational logic,Arithmetic circuits: Half adder, Full adder,Halfsubstractor,Full subtractor; Multiplexer, Encoder, Demultiplexer& Decoder. **Flip flops:** Introduction, S-R flip -flops, Level & edge triggered flip flops, JK flip-flop, D flip-flop, T flip-flop,Master slave JK flip-flop, Flip flop timing parameters & applications	**8**
IV	**Shift Registers:** Shift register, Ring counter, Universal shift registers, SISO, PISO, SIPO & PIPO. **Counters:** Asynchronous ripple counter, Synchronous counter, Modulus of a counter,Binary ripple counter, Up& down, Decade counter.	**8**

	Semiconductor Memories: Classification of memories,ROM, RAM, Static memory and Dynamic memory. Programmable logic arrays, Charged-coupled device memory	

Text Books

1. ***Digital Electronics -Principle & Integrated circuits***, Anil K Maini, Wiley India edition
2. ***Modern Digital Electronics***, R.P.Jain, TMH
3. M. Morris Mano, ***Digital Design***, Prentice Hall of India.

Reference Books

1. ***Digital Principle and Applications***, Malvino and Leach, TMH
2. ***Digital Electronics***, Kharate, Oxford University Press

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EC-303: NETWORK ANALYSIS & SYNTHESIS

Teaching Scheme			Credits	Marks			Duration End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
3	1	0	3	40	60	100	3 hrs

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**Analysis of coupled circuits and application of network theorem in AC circuits:** Active element conventions: Modelling of coupled circuits, Dot convention in coupled circuits; Network theorems in AC circuits:Thevenin's and Norton's theorems, Superposition theorem, Reciprocity and maximum power transfer theorem. **Graph theory and network equations:** Introduction and graph of a network, The incidence matrix, Fundamental cut set matrix, Fundamental tie set matrix and loop currents, Relation between various matrices. Network equilibrium equations: using KVL and KCL;Networks with mutual inductance, Duality.	9
II	**Application of Laplace transform in circuit analysis:** Review of Laplace transform: Definition of Laplace transform and its inverse, Laplace transform of basic functions, Properties of Laplace transform; Application of Laplace transforms in circuit analysis: Transformation of time domain circuit components to s- domain, Laplace transformtosolution of network problems. **Transient response:** Transient response of R-L, R-C, R-L-C circuits(series combinations only) for DC and sinusoidalexcitations.	9
III	**Two port networks:** Concept of two port networks, Classification of parameters: Open circuit and Short circuit parameters, Transmission and inverse transmission parameters, Hybridand inverse hybrid parameters;Condition for reciprocity and symmetry, Inter-relationship between the parameters. Interconnection of two port networks: Series, Parallel,Cascade and series-parallel connection.T and pi representations.	8
IV	**Fundamentals of network synthesis:** Network functions, Concept of poles and zeros,Necessary condition of a stability of a network function. Hurwitz polynomial and its properties, Positive real function, Properties of positive real functions, Testing a positive real function, Synthesis of R-L, R-C and L-C driving point functions: Foster and Cauer forms.	8

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Text Books

1. ***Fundamentals of Electric circuits***, Charles K Alexander, Matthew N O Sadiku, TMH
2. ***Circuit Theory -Analysis and synthesis***, A. Charkrabarti,DhanpatRai& co.
3. ***Network analysis and synthesis***, Franklin F. Kuc, PHI.

Reference Books

1. ***Networks and Systems***, D.RoyChoudhury, New Age International.
2. ***Network Analysis,*** Van valkenberg, PHI
3. ***Engineering Circuit Analysis***, WiliamHayt and Jack Kemmerly, TMH
4. ***Circuits and Networks- Analysis and Synthesis***,A.Sudhakar and S.P.Shyam Mohan, TMH

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EC-304: SIGNALS & SYSTEMS

Teaching Scheme			Credits	Marks			Duration End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
3	1	0	4	40	60	100	3 hrs

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**Introduction:** Signals and functions, classification of signals, Operations on Signals, Classification of Systems.Inter-connection of systems, systems with and without memory, causality, stability, linearity and time invariance.Time-domain representation and analysis of LTI and LSI systems usinginput-output relationships and unit impulse response.	8
II	**LTI systems:** Response of LTI systems: Convolution sum, convolution integral and their evaluation; Causality and stability considerations. **Continuous time Fourier series:** Introduction, Fourier series representation for continuous time periodic signals, convergence of Fourier series,properties of continuous time Fourier series, Frequency Spectrum of Continuous periodic Signals,Parseval's Theorem.	9
III	**Continuous time Fourier transforms:** Introduction, convergence of Fourier transform, Fourier transform evaluation of various continuous signals, properties of continuous time Fourier transform. **Laplace transform:** Region of convergence, properties of Region of convergence, Analysis of continuous time systems, Transfer function, properties of Laplace transforms, Inverse Laplace transforms.	8
IV	**Z-Transform:** Region of convergence, Properties of Region of convergence, Analysis of LSISystems, Transfer function, properties of Z-transforms, Inverse Z-transforms. **Signal sampling:** Introduction, Need for sampling, Sampling theorem, Impulse-train sampling, Data reconstruction of signal from its samples, Critical sampling, Over sampling and under sampling – Aliasing.	8

Text Books

1. ***Signals and Systems***, Oppenheim, Willsky& Hamid Nawab, Pearson Education.
2. ***Signals & Systems***,V.Krishnaveni and A. Rajeswari, Wiley India.

Reference Books

1. ***Signals and Systems,***ANagoor, TMH.
2. ***Continuous Signals and Systemswith MATLAB,***TaanElAli, Mohammad A. Karim, CRC Press.
3. Fourier and Laplace Transforms, R. J. Beerends, Cambridge University Press.
4. Fundamentals of Signals & Systems, Roberts, TMH
5. Getting Started with MATLAB, RudraPratap, Oxford University Press.

HS 306: SOCIOLOGY AND ELEMENTS OF INDIAN HISTORY FOR ENGINEERS

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
2	0	0	2	40	60	100	3 hrs

COURSE OBJECTIVE:

- To familiarize the students with elements of Indian history and sociological concepts and theories by which they could understand contemporary issues andproblems in Indian society.
- The enable the students to analyse critically the social processes of globalization, modernization and social change.
- To help the students imbibe such skills that will enable them to be better citizens and human beings.

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**Introduction to sociological concepts** - structure, system, organization, social institution, Culture social stratification (caste, class, gender, power). **Understanding social structure and social processes -** Perspectives of Marx and Weber.	**6**
II	**Political economy of Indian society** - Industrial, Urban, Agrarian and Tribal society. **Social change in contemporary India** - Modernization and globalization, Secularism and communalism.	**6**
III	**Introduction to Elements of Indian History -** What is history? ; History Sources - Archaeology, Numismatics, Epigraphy and Archival research. **Indian history and periodization -** evolution of urbanization process: first, second and third phase of urbanization.	**6**
IV	**From feudalism to colonialism** -the coming of British; Modernity and struggle for independence. **Issues and concerns in post-colonial India (upto 1991) -** Issues and concerns in post-colonial India 2ndphase (LPG decade post 1991)	**6**

Text Books:

1. Desai, A.R. (2005), ***Social Background of Indian Nationalism***, Popular Prakashan.
2. Giddens, A (2009), ***Sociology, Polity***, 6thEdition.
3. Chandoke, Neera& Praveen Priyadarshi(2009), ***contemporary India: Economy, Society and Politics,*** Pearson.

Reference Books:

1. Guha, Ramachandra(2007), ***India After Gandhi***, Pan Macmillan.
2. Haralambos M, RM Heald, M Holborn (2000), ***Sociology,*** Collins.
3. Sharma R. S..(1965), ***Indian feudalism***, Macmillan.
4. Gadgil, Madhab&RamchandraGuha(1999) - ***This Fissured Land: An Ecological Histry of India,*** OU Press.

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HS 307: GERMAN LANGUAGE – I

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
2	0	0	2	40	60	100	3 hrs

COURSE OBJECTIVES:

- To read and write short, simple texts.
- To understand a dialogue between two native speakers and also take part in short, simple conversations using the skills acquired.
- To offers opportunities for students of engineering for higher studies, research and employment in Germany.

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**WichtigeSprachhandlungen:** Phonetics – Sichbegrüßen - Sich und anderevorstellenformell / informell - Zahlen von 1 bis 1 Milliarde - verstehen&sprechen. **Grammatik:** regelmäßigeVerbenimPräsens - "sein" und habenimPräsens – PersonalpronomenimNominativ.	6
II	**WichtigeSprachhandlungen:**TelefonNummernverstehen und sprechenUhrzeitenverstehen und sagenVerneinung "nicht und kein" (formell und informell) **Grammatik**: Wortstellung – Aussagesatz – W-Frage und Satzfrage (Ja/NeinFrage) Nomenbuchstabieren und notierenbestimmter und unbestimmterArtikelundNegativartikelim Nom. &Akkusativ	6
III	**WichtigeSprachhandlungen:** Tageszeitenverstehen und überTerminesprechen-Verabredungenverstehen - AufgabenimHaushaltverstehen **Grammatik:** PersonalpronomenimAkkusativ und Dativ - W-Fragen "wie, wer, wohin,wo, was usw.-GenitivbeiPersonennamen - ModalverbenimPräsens "können, müssen,möchten".	6

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IV	**WichtigeSprachhandlungen:** Sichaustauschen, was man kann, muss – BezeichnungenLebensmittel – Mengenangabenverstehen – PreiseverstehenundEinkaufzettelschreiben **Grammatik:**Wortstellung in SätzenmitModalverben – Konnektor ”und” – “noch”-kein-------mehr – “wieviel, wieviele, wie alt, wielange” – PossessivartikelimNominativ.	**6**
V	**WichtigeSprachhandlungen:** Freizeitanzeigenverstehen – HobbysundSportartenAnzeigenfürFreizeitpartnerschreibenbzw. daraufantworten –Vorlieben und Abneigungenausdrucken **Grammatik:**VerbenmitVokalwechselimPräsens – ModalverbenimPräsens“dürfen, wollen und mögen - “haben und sein” imPräteritum – regelmäßigeVerbenimPerfekt – Konnektoren “denn, oder, aber.	**6**

Text Book

1. Studio d A1. Deutsch alsFremdsprache with CD.(Kursbuch und Sprachtraining).

Reference

1. German for Dummies
2. Schulz Griesbach

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HS 308: FRENCH LANGUAGE - I

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
2	0	0	2	40	60	100	3 hrs

COURSE OBJECTIVES:

- To read and write short, simple texts.
- To understand a dialogue between two native speakers and also take part in short, simple conversations using the skills acquired.
- To offers opportunities for students of engineering for higher studies, research and employment in French.

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**Grammar and Vocabulary:** Usage of the French verb "se presenter", a verbof self- introduction and how to greet a person- "saluer". **Listening and Speaking:** The authentic sounds of the letters of the Frenchalphabet and the accents that play a vital role in the pronunciation of thewords. **Writing:**Correct spellings of French scientific and technical vocabulary. **Reading:** Reading of the text and comprehension – answering questions.	**6**
II	**Grammar and Vocabulary:** Definite articles, "prepositions de lieu" subjectpronouns. **Listening and Speaking:**Pronunciation of words like Isabelle, presentezandla liaison – vousetes, vousappelez and role play of introducing each other –group activity. **Writing:**Particulars in filling an enrolment / registration form. **Reading Comprehension:** reading a text of a famous scientist and answeringquestions.	**6**
III	**Grammar and Vocabulary:** Verb of possession "avoir' and 1st group verbs"er", possessive adjectives and pronouns of insistence- moi, lui..andnumbers from 0 to 20. **Listening and Speaking: N**asal sounds of the words like feminine, ceinture,parfum and how to ask simple questions on one's name, age, nationality,address mail id and telephone number. **Writing:**Conjugations of first group verbs and paragraph writing on self – introduction and introducing a third person.	**6**

	Reading Comprehension: reading a text that speaks of one's profile andanswering questions	
IV	**Grammar and Vocabulary:** Negative sentences, numbers from 20 to 69, verb"aimer"and seasons of the year and leisure activities. **Listening and Speaking:** To express one's likes and dislikes and to talk ofone's pastime activities (sports activities), je fais du ping-pong and nasalsounds of words – janvier, champagne. **Writing-**Conjugations of the irregular verbs: faire and savoir and their usage.Paragraph writing on one's leisure activity- (passé temps favori). **Reading:** a text on seasons and leisure activities – answering questions.	**6**
V	**Grammar and Vocabulary:** les verbes de direction- to ask one's way and togive directions, verbes- pouvoir and vouloir and 2nd group verbs, a droite, lapremiere a gauche and vocabulary relating to accommodation. **Listening and Speaking:**To read and understand the metro map and henceto give one directions – dialogue between two people. **Writing:**Paragraph writing describing the accommodation using the differentprepositions like en face de, derriere- to locate. **Reading Comprehension:**A text / a dialogue between two on location anddirections- ouest la poste/ la pharmacie, la bibliotheque?.....	**6**

Text Book

1. Tech French

Reference

1. French for Dummies.
2. French made easy-Goyal publishers
3. Panorama

EC-305: ANALOG ELECTRONICS LAB

Teaching Scheme			Credits	Marks			Duration End Semester Examination
L	T	P/D	C	I.A.	ESE	Total	
0	0	2	1	30	20	50	3 hrs

Experiments as per the topics in the syllabus for the course 'Analog Electronics Lab' will be conducted in the laboratory class. Following is the list of experiments out of which 8-9 experiments must be performed during the semester:

List of Experiments:

1. To study the characteristics of different types of Diodes.
2. Find out h-parameters of BJT
3. Design and implement CE-BJT amplifier and verify various parameters
4. To study the two stage RC coupled transistor amplifier.
5. To study Class-B push pull amplifier at audio frequency.
6. To find the Efficiency of Class-A or Class AB Amplifier.
7. To plot frequency response of Single Tuned Amplifier.
8. To study the frequency response of BJT amplifier with and without feedback.
9. To study effects of Voltage Series Feedback.
10. To study effects of Voltage Shunt Feedback
11. To study modelling of circuits with optoelectronic devices using simulation software.
12. To study current voltage characteristics of LED.

NOTE : The above experiments may also be performed on simulation software

EC-306 : DIGITAL ELECTRONICS LAB

Teaching Scheme			Credits	Marks			Duration End Semester Examination
L	T	P/D	C	I.A.	ESE	Total	
0	0	2	1	30	20	50	3 hrs

Experiments as per the topics in the syllabus for the course 'Digital Electronics lab.' will be conducted in the laboratory class. Following is the list of experiments out of which 8-9 experiments must be performed during the semester:

List of Experiments:

1. To verify the truth table of logic gates realize AND, OR, NOT gates
2. To realize AND, OR gates using diodes and resistors
3. Implementation of X-OR and X-NOR using NAND and NOR gates.
4. Design of a digital circuit using K-map and realise by using NAND-NAND or NOR-NOR gates.
5. Design of an adder logic circuit.
6. Design of a subtractor logic circuit.
7. Implementation of logic equations using MUX, DEMUX
8. Design of an encoder logic circuit.
9. Design of a decoder logic circuit.
10. Conversion from one flip flop to another.
11. Design of a counter and its realization using FFs.
12. Design of a shift register and its realization using FFs.
13. Design BCD to seven-segment display using 7447 IC

NOTE: The above experiments may also be performed on simulation software

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EC-307: MAT LAB & ITS APPLICATIONS IN SIGNALS AND SYSTEMS

Teaching Scheme			Credits	Marks			Duration End Semester Examination
L	T	P/D	C	I.A.	ESE	Total	
0	0	3	2	30	20	50	3 hrs

Experiments as per the topics in the syllabus for the course 'Signals & Systems lab.' will be conducted in the laboratory class. Following is the list of experiments out of which 8-9 experiments must be performed during the semester:

List of Experiments:

1. To implement various operations on matrices like rank, transpose, sparse, null matrix, zero padding etc.
2. To read & write various file formats like xls, png, jpeg etc.
3. To plot one dimensional and two dimensional graphs using various MATLAB 2-D plots types.
4. The teacher concerned will give at least 4 exercises like roots of a quadratic equation, guessing a number, unit conversion, factorial program etc. to demonstrate MATLAB environment.
5. To represent basic signals (Unit step, unit impulse, ramp, exponential, sine and cosine).
6. To study operations on signals.
7. To study convolution of continuous signals.
8. To study frequency spectrum ofvarious signals.
9. To analyse different pulses to obtain relationship between time domain and frequency domain.
10. To study signal sampling& aliasing.
11. To study laplace transform and z-transform.
12. To study convolution of discrete signals.

NOTE: All the practicals must to be performed on MATLAB.

SEMESTER-IV

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MA 401: OPTIMIZATION AND CALCULUS OF VARIATIONS

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
2	2	0	3	40	60	100	3 hrs

COURSE OBJECTIVES:

The objective of this course is to present different methods of solving optimization problems in the threeareas of linear programming, nonlinear programming, and classical calculus of variations.In addition to theoretical treatments, there will be some introduction tonumerical methodsfor optimization problems.

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**Introduction:** A survey of some simplified examples of common real world situationsleading to optimization problems, basic formulation and theory of optimization problems. **Linear programming:**Linear programming (optimization of linear functions subject tolinear constraints): basic theory; simplex method; duality, practical techniques.	7
II	**Linear programming:**Basic LPP - solution techniques (Simplex, Artificial Basis), Complimentary Slackness Theorem,Fundamental theorem of Duality,degenerate solutions, cycling; Applications - elements of dynamic programming includingHamiltonian, Bellman'soptimality principle. **Transportation and Assignment Problems:** Solution of a balanced transportation problem, degeneracy in transportation problems and alternate solutions, Mathematical problems in formulation of assignment problems.	8
III	**Nonlinear programming:** Nonlinear programming (optimization of nonlinear functionssubject to constraints) with Lagrange multipliers, Karush-Kuhn-Tucker optimality conditions,convexity, duality. **Approximation methods for nonlinear programming:** Line search methods, gradientmethods, conjugate gradient methods; Networkingtechniques – PERT and CPM.	7

IV	**Calculus of Variations:**Basic definitions -functionals, extremum, variations, function spaces; Necessary conditions for an extremum, Euler-Lagrange Equation, convexity and it's role in minimization, minimization under constraints; Existence and nonexistence of minimizers;Applications - Isoperimetric problems, Geodesics on the surface.	**7**

Text Books:

1. C. B. Gupta, ***"Optimization Techniques in Operation Research***," I. K. InternationalPublishing House Pvt. Ltd.
2. A. S. Gupta, ***Calculus of Variations and Applications***, PHI Prantice hall India.
3. Mukesh Kumar Singh, ***"Calculus Of Variations"*** Krishna Prakashan Media (P) Ltd.
4. J. K. Sharma, ***Operations Research – Problems and Solutions***, Macmillian Pub.

Reference books:

1. I. M.Gelf and S. V. Fomin, ***"Calculus of Variations"*** Dover Publications IncMineola,New York.
2. Purna Chand Biswal, ***"Optimization in Engineering***, Scitech Publications India Pvt. Ltd.
3. B. S. GREWAL, ***Higher Engineering Mathematics***, Krishna Publications.
4. G. Hadly, ***Linear Programming***, Narosa Publishing House.
5. KantiSwarup, P. K. Gupta and Manmohan, ***"Operations Research***," Sultan Chand & Sons.

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HS 409: HUMAN VALUES AND PROFESSIONAL ETHICS

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
2	2	0	3	40	60	100	3 hrs

COURSE OBJECTIVES:

- To enable students to explore the purpose of value education.
- To understand the purpose of harmony with oneself, family, society and nature.

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**Introduction –Need and Basic Guidelines** 1. Understanding the need , basic guidelines, content and process of value Education 2. Self-Exploration – purpose, content and process, 'Natural Acceptance' and Experiential Validation – as the mechanism for self-explanation.	6
II	**Process for Value Education** 1. Continuous Happiness and Prosperity – A look at basic Human Aspirations. 2. Right Understanding, Relationship and Physical Facilities – basic requirements for fulfillment of aspirations of every human being with their correct priority 3. Understanding Happiness and prosperity – A critical appraisal of the current scenario. 4. Method to fulfill the human aspirations; understanding and living in harmony at various levels	7
III	**Harmony in Human Beings** 1. Understanding human being as a co-existence of the self and the body. 2. Understanding the needs of Self ('I') and 'Body' – Sukh and Suvidha. 3. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer)	7
IV	**Harmony in Myself and body** 1. Understanding the characteristics and activities of 'I' and harmony in 'I' **2.** Understanding the harmony of I with the Body: Sanyam and Swasthya: correct appraisal of Physical needs, meaning of Prosperity	6

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	in detail.	
V	**Harmony in Family, Society and Nature** 1. Understanding harmony in the family, society and nature. 2. Understanding values in human relationship; meaning of Nyaya and Program for its fulfillment to ensure Ubhay-tripti. 3. Trust (Vishwas) and Respect (Samman) as the foundational values of relationship.	**6**

Text Books

1. R R Gaur, RSangal and GP Bagaria, ***A Foundation Course in value Education***, Published by Excel Books (2009).
2. R R Gaur, R Sangal and G P Bagaria, ***Teacher's Manual (English),*** 2009.

Reference Books

1. E.F. Schumacher, ***Small is Beautiful; a study of economics as if people mattered***, Blond & Briggs, Bratain, 1973.
2. PL Dhar, RR Gaur, ***Science and Humanism***, common wealth publishers, 1990.
3. A.N. Tripathy, ***Human values,*** New Age International Publishers, 2003.
4. E.G. Seebauer& Robert, L BERRY, ***Foundational of Ethics for Scientists &Engineers***, Oxford University Press, 2000.
5. M. Govindrajran, S.Natrajan& V.S. Senthi Kumar, ***Engineering Ethics (including human Values),*** Eastern Economy Edition, Prentice hall of India Ltd.
6. B.L. Bajpai, 2004, ***Indian Ethos and Modern Management***, New Royal book Co; Lucknow, 2004, Reprinted 2008.

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EC-401: ANALOG COMMUNICATION

Teaching Scheme			Credits	Marks			Duration End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
3	1	0	4	40	60	100	3 hrs

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**Introduction:** Information, Transmitter, Channel, Noise, Receiver.Modulation: Description, Need of modulation;Types of channels: Characteristics & modelling, Need for wireless communication, Electromagnetic spectrum range & applications. **Spectral density and correlation:** Correlation, Cross correlation & auto-correlation, Energy spectral density, Correlation of energy signals, Power spectral density, Correlation of power signals, Properties of energy & power spectral density.	**8**
II	**Noise:** External noise: Atmospheric, Extra-terrestrial, Industrial; Internal noise: Thermal, Shot, Flicker noise, Transit time, Partition noise; Voltage and current models of a noisy resistor, Noise figure: SNR, Definition of noise figure; Equivalent noise bandwidth, Noise temperature, White noise, Narrowband noise. **Probability theory and random processes:** Probability theory, Random variables, Gaussian distribution, Random process, Stationary, Mean, Correlation, and covariance functions, Ergodic process, Gaussian process, Properties of cross-correlation & autocorrelation functions.	**8**
III	**AM theory:** AM representation, DSB-FC, DSB-SC, SSB, VSB, Power & current calculations. **AM transmission:** Introduction, Generation of amplitude modulation, Low level and high level modulation, Basic principle of AM generation, Generation of DSB-FC: Square law diode modulation, Switching modulation; Generation of DSB-SC: Balanced modulator, Ring modulator; Generation of SSB: Filter method, Phase shift method, Third method; VSB modulation and demodulation/ General theory of sideband filtering. **AM detector:** DSB-FC detector: Square law detector, Envelope or diode detector; DSB-SC detector: Synchronous detector, Costa's receiver; SSB detector: Synchronous/ Coherent detector. **AM reception:** Characteristics parameter of a receiver: Selectivity, Sensitivity and fidelity; Super heterodyne receiver: Basic elements of AM super-heterodyne receiver, Image frequency and its rejection, Tuning and tracking of SHD, Automatic gain control.	**10**

IV	**Angle modulation:** Angle modulation – Representation of frequency modulation and phase modulation signal, Narrowband FM and sinusoidal FM(wideband FM), Frequency spectrum for sinusoidal FM, Average power and transmission bandwidth of FM, Non-sinusoidal modulation: Deviation ratio, Phase modulation; Equivalence between PM and FM, Sinusoidal phase modulation. **Angle generation of FM:**Direct method (Parameter variation method), Indirect method (Armstrong's method) **Angle modulation detectors:** Slope detector, Balanced slope detector, Foster-Seeley discriminator, Ratio detector, Quadrature detector, PLL demodulator, Amplitude limiters, Pre-emphasis and de-emphasis, FM radio broadcasting and FM stereo broadcasting.	**9**

Text Books

1. Communication Systems, Singh & Sapre, TMH
2. Communication Systems, Kennedy, TMH
3. Communication Systems, Dennis Roddy, Pearson.

Reference Books

1. Electronic Communication Systems, Wayne Tomasi, Pearson.
2. Principles of Communication System, Taub and Schilling, McGraw Hill
3. Communication Systems, Simon Haykin, Wiley

EC-402: MICROPROCESSORS & PERIPHERALS

Teaching Scheme			Credits	Marks			Duration End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
3	1	0	4	40	60	100	3 hrs

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**Introduction:** Evolution of microprocessor, 8085 microprocessor: Features, Architecture and pin configuration; 8085 instruction: Instruction word size, Opcode format, Data format, Addressing modes; 8085 machine cycles and timing diagrams. **Typical instruction set of 8085:** Data transfer instructions, Arithmetic instructions, Logic and bit manipulation instructions, Branch instructions, Machine control instruction.	**8**
II	**Programming:** Development of assembly language program. **Interrupts & data transfer:** Interrupt system of 8085, Stack and subroutine. **Memory interfacing:** Types of memory, Memory map and address range, Memory interfacing decoding techniques:absolute and partial.	**8**
III	**I/O interfacing:** Basic interfacing concept using mapping techniques: I/O mapped I/O and memory mapped I/O **Serial I/O:** Basic concepts in serial I/O, Asynchronous serial data communication using SOD and SID. **Peripheral devices & applications of microprocessor:** Description of the 8251 programmable communication interface, The 8255 programmable peripheral interface, The 8257 DMA controller.	**9**
IV	**Trends in microprocessor technology:** 8086/8088 microprocessor: Main features, Architecture-the execution unit and bus interface unit, Memory segmentation, Memory addressing, 8086/8088 hardware pin signals, 8086 minimum and maximum modes of operation; Introduction to 8087 floating point coprocessor and its connection to host 8086.	**9**

Text Books

1. ***Microprocessor Architecture, programming and application with 8085***, Gaonkar, PHI.
2. ***Microprocessors and Interfacing*** , D.V.HALL, McGraw Hill

3. ***Microprocessor and Microcontrollers***, Senthil, Saravanam ,Oxford University Press

Reference Books

1 ***An introduction to microprocessor***, A.P. Mathur, TMH.
2 ***The 8086 Microprocessor***, Kenneth J Ayala, Cengage Learning
3. ***Fundamentals of microprocessor & microcomputers***, B.Ram, Dhanpat Rai& Co.

EC-403: LINEAR INTEGRATED CIRCUITS

Teaching Scheme			Credits	Marks			Duration End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
3	1	0	3	40	60	100	3 hrs

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**Introduction to Operational Amplifiers and Characteristics:** Introduction, Block diagram, Characteristics and equivalent circuits of an ideal op-amp, Various types of operational amplifiers and their applications, Power supply configurations for OP-AMP applications, Inverting and non-inverting amplifier configurations. Input offset voltage, Offset current, Thermal drift, Effect of variation in power supply voltage, Common-mode rejection ratio, Slew rate and its effect, PSRR and gain – bandwidth product, Frequency limitations and compensations, Transient response, Interpretation of TL082 datasheet.	**8**
II	**Amplifiers and Active Filters:** Summing amplifier, Integrators and differentiators, Instrumentation amplifier, Differential input and differential output amplifier, Voltage-series feedback amplifier, Voltage-shunt feedback amplifier, Log/ Antilog amplifier, Isolation amplifiers. Characteristics of filters, Classification of filters, Magnitude and frequency response, Butter worth 1st and 2nd order low pass, high pass and band pass filters, Chebyshev filter characteristics, Band reject filters, Notch filter, All pass filters, Self-tuned filters	**8**
III	**Oscillators, Comparators and Converters:** Triangular/rectangular wave generator, Phase-shift oscillators, Wein bridge oscillator, Comparator, Zero Crossing detector, Monostable and Astable multivibrator, Schmitt trigger, Voltage limiters, Clipper and clampers, Absolute value output circuit, Peak detector, Sample and hold circuit, Precision rectifiers, Voltage-to-current converter, Current-to-voltage converter.	**8**
IV	**Advanced applications and Power Supply :** Design of frequency divider, PLL, AGC, AVC using OP-AMP and analog multipliers (MPY634), Design of amplitude modulator and FSK circuit using OP-AMP and analog multiplier. Unregulated power supplies, Zener diode voltage regulator, Simple OP-AMP voltage regulator, Fixed and adjustable voltage regulators, Dual power supply, Basic switching regulator and characteristics of standard regulator ICs –	**8**

	TPS40200, TPS40210, TPS 7A4901, TPS7A8300.	

Text Books

1. ***Linear integrated circuits Analysis, Design & Application***, B. Somanathan Nair, Wiley India

2. ***OP-AMP and Linear IC's***, Ramakant A.Gayakwad, PHI.

Reference Books

1. ***Operational Amplifiers and Linear Integrated circuits***, Robert Coughlin and F Driscoll, Pearson Education Asia.

2. ***Linear Integrated Circuits***, D. Roy Choudhry, Shail Jain, New Age International Pvt. Ltd.

3. ***Op Amps and Linear Integrated circuits***, James M. Fiore, First reprint, Thomson Asia Pvt. Ltd.

4. ***Operational Amplifier and LIC***, Bell, Oxford University Press.

Other References

1. Data sheet: http://www.ti.com/lit/ds/symlink/tl082.pdf
2. Application note: http://www.ti.com/lit/an/sloa020a/sloa020a.pdf
3. MPY634 data sheet: http://www.ti.com/lit/ds/symlink/mpy634.pdf
4. Application note: http://www.ti.com/lit/an/sbfa006/sbfa006.pdf
5. ASLK pro manual: ASLK manual
6. PMLK lab manual

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EC-404: PULSE SHAPING & WAVE GENERATION

Teaching Scheme			Credits	Marks			Duration End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
3	1	0	3	40	60	100	3 hrs

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**Linear Waveshaping:** Introduction to high pass & low pass RC circuit, RC circuit as a differentiator and integrator (Implementing of step, pulse, square & ramp input), Attenuators, RL and RLC circuits, Ringing circuit. **Time Base Generators:** General features of a time base signal, Methods of generating time base waveforms, Miller and Bootstrap time base generators, Current time base generators.	**8**
II	**Non-Linear Wave Shaping** **A. Clippers:** Diode clippers, Transistor clippers, Clipping at two independent levels, Transfer characteristics of clippers, Comparators, Applications of voltage comparators. **B. Clampers:** Clamping operation, Clamping circuits using diode with different inputs, Effect of diode characteristics on clamping voltage, Transfer characteristics of clampers, Clamping circuit theorem.	**8**
III	**Sampling Gates:** Basic operating principles of sampling gates, Unidirectional and Bi-directional sampling gates, Reduction of pedestal in gate circuits, Applications of sampling gates. **UJT & 555 Timer:** UJT: Construction, Principle, UJT as relaxation amplifier, 555 timer – Basic structure, Pin description,Application of 555 timer as astable multivibrator.	**8**
IV	**Non-Sinusoidal Oscillators:** Analysis and design of Bistable, Monostable, Astable Multivibrators and Schmitt trigger using transistors, Voltage controlled oscillator, Application of non-Sinusoidal oscillators. **Data Conversion Circuits:** Digital to analog converters : Simple resistive network and binary ladder network, Analog to digital converter : counter type, Successive approximation type, flash type and dual slope integration type.	**8**

Text Books

1. ***Pulse & Digital Circuits***- Anand Kumar, PHI.
2. ***Pulse Digital & Switching Waveform-*** Jacob Millman, TMH.
3. ***Pulse & Digital Circuits***- Rao. K Venkata, Pearson.

Reference Books

1. ***Fundamental of Electronics***: Thomas, Morgan & Claypool Publishers.
2. ***Electronic Devices & Circuits***- Salivahnan, TMH.
3. ***Electronic Devices & Circuit Theory***- Boylestad, Pearson.

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HS 410: LAW FOR ENGINEERS

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
2	0	0	2	40	60	100	3 hrs

COURSE OBJECTIVE:

- To familiarize students (Prospective engineers) with elementary knowledge of laws that would be of utility in their profession.
- To familiarize students with the constitution of India and laws in new areas viz. IPR, ADR, Human Rights, Right to Information, Corporate law, Law relating Elections and Gender Studies.

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**Constitutional Law:** Nature of Indian Constitution (features), fundamental rights, duties and directive Principles of State Policy (DPSP's), forms of Governments, structure of Government of India, role and responsibility of executive, legislature/parliament and judiciary, nature of Indian federal system, center state and relations. Basic structure of the Indian constitution, basic features of the Indian, constitutional amendments - GolakNath, KeshwanandaBharti, Maneka Gandhi (1978) and S.R. Bommai case (1994), (floor test).	6
II	**Law of contract:** General principles of Indian Contract Act, 1862, kinds of Government contracts and dispute settlement, standard and printed form of contract, essential elements of valid contract proposal, acceptance communication and revocation thereof, relevance of time in contractual obligation. Main objectives of Arbitrates and Conciliation Act-1996, tort and law of tort, general principles of tort law, classifications of torts: property vs. person.	6
III	**Administrative Law:** Evolution, nature and its scope, conceptual objection against growth of administrative rule of law and separation of power, clarification of administrative actions, judicial review of administrative actions, exclusion of judicial review and concept of "Ombudsman";Right to Information Act, 2005 (Sub Section 1 - 20) **Environmental Law:** Definition, meaning and its nature, environmental (Protection) Act-1986, Water (Preservation and Control of Pollution) Act-1974, Air (Prevention and Control of Pollution) Act-1981; Environmental pollution, overall remedies and procedures.	6

IV	**Human Rights:** Legality of human rights, universal declaration of human rights, 1948, difference between civil and political rights, individual and human rights - human rights of child, weaker section of society, prisoners, and refugees, International Human Rights Commission.	**6**

Text Books:

1. D.D. Basu, ***Shorter Constitution of India***, Prentice Hall of India, (1996)
2. MeenaRao, ***Fundamental concepts in Law of Contract***, 3rd Edn. Professional Offset, (2006)
3. H.O.Agarwal,***International Law and Human Rights***, Central Law Publications, (2008)

Reference Books:

1. H.M. Seervai, ***Constitutional Law of India***, Tripathi Publications, (1993).
2. S.K. Kapur, ***Human Rights under International Law and Indian Law,***Central Law Agency, (2001)
3. NeelimaChandiramani, ***The Law of Contract: An Outline***, 2nd Edn. Avinash Publications Mum, (2000)
4. Avtarsingh, ***Law of Contract***, Eastern Book Co., (2002).
5. Anson W.R.(1979), ***Law of Contract***, Oxford University Press

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HS 411: GERMAN LANGUAGE – II

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
2	0	0	2	40	60	100	3 hrs
Prerequisite							
HS 302: GERMAN LANGUAGE - I							

COURSE OBJECTIVES:

- To enable the students to speak and understand about most of the activitiesin the day to day life.
- The students will be able to narrate their experiences in Past Tense.
- The students will be able to understand and communicate even with German Nationals.
- By the end of Phase – II the students will have a reasonable level of conversational skills.

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**Wichtige Sprachhandlungen:** Zimmersuche, Möbel **Grammatik**: Verbenmittrennbaren Vorsilbenim Präsens und Perfekt. Verbenmittrennbaren Vorsilben und Modalverbenim Präsens. Verbenmituntrennbaren Vorsilbenim Perfekt.Unregelmäßige undgemischteVerbenimPerfekt.	6
II	**Wichtige Sprachhandlungen**: Kleidung ,Farben, Materialien. **Grammatik:** formelle Imperativsätzemit "Sie" informelle Imperativsätze Vorschlägemit "wir" – "sollen/wollenwir" - Sollich? Modalpartikeln "doch""mal" "doch mal.	6
III	**Wichtige Sprachhandlungen:** Sehenswürdigkeite (Prater, BrandenburgerTör, Kolossium, Eifeltürm). **Grammatik:** Ortsangabenmit Akk. Und Dativ "alle","man" Indefinitepronomen"etwas", "nichts".	6
IV	**Wichtige Sprachhandlungen:** Essen und TrinkenimRestaurant,	6

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	Partyvorbereitung und Feier. **Grammatik:** NomenausAdjektivennach "etwas"und "nichts" NomenausdemInfinitiv von Verben, zusammegesetzteNomen und ihreArtikel. Adjektiveim Nom.undAkk.nachunbestimmten Artikel, Negativartikel und Possessivartikel	

Text Books

1. Studio d A1. Deutsch alsFremdsprache with CD.(KursbuchundSprachtraining).

References

1. German for Dummies
2. Schulz Griesbach

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HS 412: FRENCH LANGUAGE - II

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
2	0	0	2	40	60	100	3 hrs
Prerequisite							
HS 303: FRENCH LANGUAGE - I							

COURSE OBJECTIVES:

- To enable the students communicate effectively with any French speaker
- To enable students to access information on the internet, send e mails, pass level 1 exam conducted by Alliance Française de Madras.
- To enable students to enhance their lexical and technical competence and have a competitive edge in the international market.By the end of Phase – II the students will have a reasonable level of conversational skills.

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**Grammar and Vocabulary:** The second group verbs: Finir, rougir, grossir,grandir. "Les preposition de temps": à, en, le, de 7h à 8h, jusqu' à, vers. Listening and Speaking – the semi- vowels: Voilà, pollutant. Writing - thedays of the week,months, technical subjects, time, "les spécialitésscientifiques et l' annéeuniversitaire, paragraph writing about time table. Reading: Reading of the text and comprehension – answering questions.	6
II	Grammar and Vocabulary – The adjectives, the nationality, feminine &masculinenoun forms "les métiersscientifiques". Listening and Speaking – Vowels: soirée, année, près de, très. Writing: Countries name, nationality, "les métiersscientifiques", numbers from:69 to infitive and some measures of unit.Reading Comprehension: reading a text.	6
III	Grammar and Vocabulary – near future, The demonstrative adjectives, Expressthe aim by using the verb, Listening and Speaking –"La liaison interdite – enhaut". Writing – some scientific terms, French expressions to accept an invitation.Sentence framing. Reading Comprehension – reading a text.	6
IV	Grammar and Vocabulary –the verbs: manger, boire, the partitive articles Listening and Speaking – "le 'e' caduc Writing- the food, the ingredients, fruits,vegetables, expression of quantity, paragraph writing about food habits. Reading –reading a text.	6

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Text Books

1. Tech French

References

1. French for Dummies.
2. French made easy: Goyal publishers.
3. Panorama.

EC-405: MICROPROCESSOR & PERIPHERALS LAB

Teaching Scheme			Credits	Marks			Duration End Semester Examination
L	T	P/D	C	I.A.	ESE	Total	
0	0	2	1	30	20	50	3 hrs

Experiments as per the topics in the syllabus for the course 'Microprocessor & peripherals lab' will be conducted in the laboratory class. Following is the list of experiments out of which 8-9 experiments must be performed during the semester:

List of Experiments:

1. Addition and subtraction of two 8-bit numbers with programs based on different addressing modes of 8085A.
2. Addition and subtraction of two 16-bit numbers using 2's complement method.
3. Addition and subtraction of two 16-bit BCD numbers using DAA instruction.
4. Multiplication of two 8-bit numbers using the method of successive addition or shift & add method.
5. Division of two 8-bit numbers using the method of successive subtraction or shift & subtract method.
6. Program for block transfer and block exchange of data bytes.
7. Finding the smallest and largest element in a block of data.
8. Arranging the elements of a block of data in ascending and descending order.
9. Generating delays of different time intervals using delay subroutines.
10. To study the interfacing of 7 segment LED display with microprocessor.
11. To study the interfacing of ADC and DAC with microprocessor.
12. To study the interfacing of stepper motor with microprocessor.
13. To study and compare main features of Intel core i3, i5 and i7

EC-406 : PULSE SHAPING, WAVE GENERATION AND LIC LAB

Teaching Scheme			Credits	Marks			Duration End Semester Examination
L	T	P/D	C	I.A.	ESE	Total	
0	0	2	1	30	20	50	3 hrs

Experiments as per the topics in the syllabus for the course 'Pulse shaping, wave generation and LIC lab' will be conducted in the laboratory class. Following is the list of experiments out of which 8-9 experiments must be performed during the semester:

Hardware required

Required tools – Power supply, Function generator, Oscilloscope, TL082, MPY634, ASLKPRO, Standard regulator ICs – TPS40200, TPS40210, TPS 7A4901, TPS7A8300, PMLK and connecting wires.

List of Experiments

1. Study the characteristics of negative feedback amplifier using op-amp.
2. Design of an instrumentation amplifier using op-amp.
3. Study the characteristics of regenerative feedback system with extension to design an astable multivibrator.
4. Design low pass, high pass and band pass, stop band 2nd order Butterworth active filters using universal active filter topology.
5. Study Wein-bridge, phase shift oscillator and determine its frequency
6. Design of a function generator and VCO using op-Amp and MPY634
7. Examine the operation of a PLL designed using TL082 and MPY634 and to determine the free running frequency, the capture range and the lock in range of PLL
8. Design an AGC and AVC using TL082 and MPY634 for a given peak amplitude of sine wave.
9. Design a low drop out regulator using TL082 for a given voltage regulation characteristic and compare the characteristics with TPS7250 IC.
10. Design of a switched mode power supply that can provide a regulated output voltage for a given input range using the TPS40200 IC.
11. Design a DC-DCconverterusing TL082 and study the time and transient response.
12. With TPS7A4901 and TPS7A8300, study:
    a. Impact of line and load conditions on drop out voltage
    b. Impact of line and load conditions on efficiency
    c. Impact of capacitor on PSRR
    d. Impact of output capacitor on load-transient response

EC-407: ELECTRONIC WORKSHOP&ANALOG COMMUNICATION LAB

Teaching Scheme			Credits	Marks			Duration End Semester Examination
L	T	P/D	C	I.A.	ESE	Total	
0	0	3	2	30	20	50	3 hrs

Experiments as per the topics in the syllabus for the course 'PCB & Electronic workshop lab' will be conducted in the laboratory class. Following is the list of experiments out of which 8-9 experiments must be performed during the semester:

List of Experiments

1. Art work and printing of simple PCB and visit to nearby silk screen printing facility.
2. Etching and drilling of PCB
3. Design and fabrication of DC regulated power supply using pre-fabricated PCB.
4. Introduction and hands on practice to use simulation software for circuit creation and simulation.
5. Design and fabrication of half adder circuit using PCB.
6. Design and fabrication of RLC resonant circuit using PCB.
7. To study Amplitude Modulation system.
8. Generation of DSB-SC signal using balanced modulator.
9. To study envelop detector for demodulation of AM signal and observe diagonal peak clipping effect.
10. To study Frequency Modulation system.
11. To study Pre-emphasis and De-emphasis.
12. To Study Super heterodyne receiver and measurement of receiver parameters like AGC, sensitivity, selectivity & fidelity.
13. Familiarization of PLL, measurement of lock and capture range, frequency demodulation.

Reference books

1. PCB Design, Walter Boshar TMH.
2. PCB Design, Coombs, McGraw Hill.
3. Integrated circuit Fabrication Technology Elliot, TMH.

SEMESTER-V
EC-501: DIGITAL COMMUNICATION

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
3	1	0	4	40	60	100	3 hrs

COURSE OBJECTIVE:

To study the conversion of a signal into digital format and identify the function of different blocks. Further the student will be able to analyze the reception of the signals. The comparative analysis of techniques to modulate and demodulate the signal will give an insight for the reduced error rates.

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**Introduction**: Digital communication, analog versus digital communication. **Sampling Theory And Practice:** Sampling theory ideal sampling and reconstruction of low pass signals, ideal sampling and reconstruction of band pass signals, practical sampling. **Pulse Modulation:** Pulse amplitude modulation (PAM), pulse position modulation (PPM), quantization process, quantization noise, A-Law, μ-Law. Pulse code modulation (PCM) system, regeneration of PCM. Differential Pulse Code Modulation (DPCM) - transmitter, receiver, processing gain. Delta modulation- transmitter, receiver, quantization error, adaptive DM.	**8**

II	**Signaling Over AWGN Channels:** Introduction to AWGN channels, geometric representation of signals, gram–schmidt orthogonalization procedure. Optimum receivers using coherent detection: maximum likelihood decoding, correlation receiver, matched filter receiver. **Baseband Data Transmission:** Baseband transmission of digital data, inter-symbol interference, nyquist channel, eye patterns.	**9**
III	**Line Codes:** Unipolar non return-to-zero (NRZ), polar NRZ, unipolar return-to-zero (RZ), bipolar RZ, manchester code. **Digital Modulation Techniques:** Binary ASK: generation & detection, Binary PSK: generation & detection, QPSK: generation & detection, OQPSK, Binary FSK: generation & detection, quadrature amplitude modulation (QAM), minimum-shift keying (MSK).	**8**
IV	***M*-ary Techniques:** Signal space representation: *M*-ary phase-shift keying, *M*-ary quadrature amplitude modulation, *M*-ary frequency-shift keying. **Noise in Digital Communication:** Bit error rate (BER), detection of single pulse in noise, optimum detection of binary PAM in noise, optimum detection of BPSK, detection of QPSK & QAM in noise, optimum detection of Binary FSK.	**9**

Text Books:

1. Simon Haykin, "***Digital Communication Systems"***, Wiley.
2. Simon Haykin, "***Introduction to Analog & Digital Communication"***, Wiley.

Reference Books:

1. Ian Glover,**"*Digital Communications"***, Prentice Hall.
2. Shanmugan, "***Analog & Digital Communication"***, Wiley.
3. Andy Bateman, "***Digital Communications: Design for The Real World"***, Pearson Publication.
4. M. A. Bhagyaveni, "***Introduction to Analog and Digital Communication"***, River Publishers.

EC-502: ELECTROMAGNETIC FIELD THEORY

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
3	1	0	4	40	60	100	3 hrs

COURSE OBJECTIVE:

To lay the foundation of electromagnetism and its practices in modern communications such as wireless and guided wave technologies. The course is designed to provide the basic skills required to understand, develop and design various engineering applications involving electromagnetic fields. The students will be able to understand the concepts of applied electrostatics and magnetostatics along with their applications in Uniform plane wave and Transmission lines.

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**Vectors And Coordinate Systems:** The del operator, gradient of a scalar, divergence of a vector, curl of a vector and their physical interpretations. Divergence's theorem and stoke's theorem, cartesian, cylindrical and spherical coordinate systems, conversion of coordinates of a point from one system to another. **Electrostatics:** Review of electrostatic basics: coulomb's law, electric field intensity, potential, gauss law and its applications for point charge, line charge density and surface charge density, boundary conditions for electric fields at dielectric-dielectric and dielectric-conductor interfaces, poisson's and laplace's equations.	8
II	**Magnetostatics:** Review of magnetostatic basics: current densities, biot-savarts law, guass law for magnetostatics, ampere's circuital law, inconsistency of ampere's circuital law – concept of displacement current, vector magnetic potential, boundary conditions for magnetic fields. **Maxwell Equations:** The equation of continuity and relaxation time, magnetic induction and faraday's law, maxwell equations and their	9

	derivations in integral and differential forms, physical interpretation of maxwell equations.	
III	**Uniform Plane Wave:** Dielectric mediums, time harmonic EM fields, electromagnetic wave equation – in free space and dielectrics, EM wave equation for time harmonic fields, propagation constant and intrinsic impedance, helmholtz wave equation, solution of helmholtz wave equation, equation of electric field of uniform plane wave in phasor form and real instantaneous form, relation between E and H, poynting theorem, depth of penetration, plane wave in good conductor and good dielectric mediums, polarization of EM wave - linear, circular and elliptical polarizations, normal and oblique incidence of linearly polarized wave at dielectric-dielectric and dielectric-conductor interfaces.	**8**
IV	**Transmission Lines Theory:** Electrical equivalent circuit for transmission lines, the transmission line equation, primary and secondary constants of transmission lines, lossless transmission line, transmission line parameters - input impedance, SWR and reflection coefficient. Calculation of transmission line parameters for various lengths and load impedances - infinite long, open circuited and short circuited transmission lines, quarter wave transformer, impedance matching, stub matching, smith chart.	**9**

Text Books:

1. Matthew N. O. Sadiku, "***Elements of Electromagnetics"***, Oxford publications.
2. Edward C. Jordan, "***Electromagnetic waves and Radiating Systems",*** Prentice-Hall.

Reference Books:

1. Hayt and Buck, "***Engineering Electromagnetics"***, TMH.
2. Daniel Fleisch, "***A student's guide to Maxwell's equations"***, Cambridge Press.
3. Krauss JDF, "***Electro-Magnetic"***, Mc Graw Hill.
4. Nannapaneni Narayana Rao, "***Elements of Engineering Electromagnetics"***, PHI.

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EC-503: ELECTRONIC LOGIC CIRCUIT DESIGN

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
3	0	0	3	40	60	100	3 hrs

COURSE OBJECTIVE:

To introduce the basic knowledge of digital logic levels and application of knowledge to understand digital electronics circuits.Understand the elements of digital system abstractions such as digital representations of information, digital logic, Boolan algebra, state elements and finite state machine (FSMs).and to design and analyze combinational& sequential logic circuits.

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**Introduction:** The switching circuit, classification of switching circuits, asynchronous and synchronous circuits, state diagram and state table. **Sequential logic design:** Introduction to sequential circuits, registers, applications of shift registers, ripple or asynchronous counters, synchronous counters, up down counters, modulo counters, decade counter, design of counters (binary & non-binary).	9
II	**Synchronous sequential circuit design:** Introductory example, finite state model – basic definition, capabilities and limitation of finite state machines, state equivalence & machine minimization, simplification of incompletely specified machines, extraction of maximal compatibles, synthesis & analysis of synchronous sequential circuits.	8
III	**Design and analysis of Asynchronous sequential circuits:** Introduction to asynchronous circuits, timing diagram, state diagram & flow tables, fundamental mode circuits, synthesis, state assignment in asynchronous sequential circuits. **Combinational logic design:** Combinational circuit design using multiplexer, ROM, PAL, PLA.	8

IV	**Hazards:** Introduction, gate delays, generation of spikes, production of static hazards in combinational networks, elimination of static hazards, design of hazard free combinational networks, hazard free asynchronous circuit design, dynamic hazards, essential hazards. **Decomposition of sequential systems:** Types of decomposition, conditions for serial and parallel decomposition.	**9**

Text Books:

1. ***"Switching and finite automata theory"***, ZVI Kohavi.
2. A. Anand Kumar, "***Switching Theory and Logic Design",***PHI Learning Pvt. Ltd.
3. C.V.S.Rao, "***Switching Theory and Logic Design"***, Pearson Education.

Reference books:

1. Dr. Sanjay Sharma, "***Switching Theory and Logic Design"***, S.K. Kataria & Sons;
2. ***Logical design of switching circuits,*** Douglas Lewin.
3. David .J .Comer, ***Digital logic & State Machine Design,*** Oxford University Press.

EC-504: ELECTRONIC MEASUREMENT & MEASURING INSTRUMENTS

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
3	0	0	3	40	60	100	3 hrs

COURSE OBJECTIVE:

To study various instruments with respectiveaccuracy, precision, resolution, reliability, repeatability, validity, errors and their analysis with appropriate standards of measurement. Student will be capable to monitor, analyze and control any physical system. The course will enable students to design and create novel products and solutions for real life problems and will introduce them a knowledge to be used in modern tools necessary for projects.

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**Units Standards & Errors:** SI units, absolute standards (international, primary, secondary & working standards), true value, errors (gross, systematic, random), static characteristics of instruments (accuracy, precision, sensitivity, resolution & threshold). **Instruments For Generation And Analysis Of Waveforms:** Signal generators, function generator, wave analyzer, harmonic distortion analyzer, spectrum analyzer, spectrum analysis.	8
II	**Bridges:** Wheat stone bridge, kelvin's bridge method. **AC Bridges:** Inductance comparison bridge, capacitance comparison bridge, maxwell's bridge, hay's bridge, anderson bridge, owens bridge, de-sauty's bridge, schering bridge & weins bridge, meggar, shielding & earthing.	9
III	**Transducers:** Principles of operation, strain gauge, LVDT, thermocouple, RTD, piezoelectric crystal and photoelectric transducers.	8

	Electronic Instruments: Electronic voltmeter, transistor voltmeter, electronic multimeter, data acquisition System (DAS).	
IV	**Telemetery:** Introduction, types of telemetery systems and applications. **Oscilloscopes and Recorders:** Simple CRO block diagram, CRT features, dual beam-dual trace oscilloscope, sampling oscilloscope, recorders: X-Y recorder, magnetic recorders; display devices (LED, LCD, alphanumeric displays).	**9**

Text Books:

1. A.K.Sawhney, ***A Course in Electrical and Electronic Measurements and Instrumentation***, Dhanapat Rai & Sons.
2. James W. Waley, William F. Riley, Kenneth G. Mcconnell, ***Instrumentation for Engineering Measurements.***
3. H. S. Kalsi, ***Electronic Instrumentation,*** Tata McGraw Hill Publishing Company Ltd.

Reference Books:

1. Earnest .O Doeblin, ***Measurement Systems Application and Design***, McGraw Hill.
2. A.K. Sawhney,***A Course in Electrical and Electronic Measurements and Instrumentation***, Dhanapat Rai & Sons.
3. ***Digital Instrumentation***, A.J. Bouwens McGraw Hill.
4. ***Intelligent Instrumentation***, Geroge C. Barney, IEEE, 1992.
5. Albert.D. Helfrick and William, ***Modern Electronic Instrumentation and Measurement Techniques***D. Cooper Pearson education.

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EC-505: POWER ELECTRONICS

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
2	2	0	3	40	60	100	3 hrs

COURSE OBJECTIVE:

To understand and acquire knowledge about various power semiconductor devices and to analyze and design different power converter circuits.

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**Power Electronics Devices:** Role of power electronics, construction and characteristics of power diode, power transistor, power MOSFET, SCR, GTO, TRIAC and DIAC, SCR- two transistor analogy, methods of turn-on – R, RC and UJT firing circuits, commutation techniques, series and parallel operation.	8
II	**Phase Controlled Converters (AC to DC converters):** One, two, three and six pulse converters, fully and half controlled converters, load voltage waveforms with different types of loads, concept of freewheeling diode, output voltage equations, continuous and discontinuous modes of operation, input power factor of converter, effect of source inductance, introduction to four quadrant/dual converter.	9
III	**Cycloconverters (AC to AC converters):** Basic principle of frequency conversion, types of cycloconverters, principle of operation of step up and step down cycloconverter, single phase to single phase cycloconverter with resistive and inductive load, three-phase to single phase cycloconverters, three phase to three phase cycloconverters with resistive load only, output voltage equation of cycloconverters.	8
IV	**Choppers (DC to DC converters):** Classification of choppers and	9

	principle of operation- buck converter, boost converter, buck-boost converter, cuk converter. **Switch Mode DC-AC Inverters:** Basic concept of switch mode inverters, uninterrupted power supply, single phase inverters.	

Text Books:

1. M.H. Rashid, ***Power Electronics: Circuits, Devices & Applications,*** Prentice Hall of India Ltd.
2. P.S. Bimbhra, ***Power Electronics***, Khanna Publishers.

Reference Books:

1. V.R. Moorthi, ***Power Electronics: Devices, Circuits and Industrial Applications,*** Oxford University Press.
2. Mohan, Undeland, Robbins, ***Power Electronics: Converters, Applications and Design***, John Wiley & Sons.
3. M.D. Singh and K.B. Khanchandani,***Power Electronics***, Tata MC Graw Hill Pub.

EC-506: INTRODUCTION TO MICROCONTROLLERS FOR EMBEDDED SYSTEMS

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
3	0	0	3	40	60	100	3 hrs

COURSE OBJECTIVE:

The student will be able to program a microcontroller to perform various tasks and can interface a microcontroller to various peripherals, sensors etc. Effective utilization of microcontroller peripherals will provide designing and implementation of a microcontroller-based embedded system.

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**Fundamentals Of Microcontrollers For Embedded Systems:** Embedded system overview, applications, features and architecture considerations-ROM, RAM, timers, data and address bus, I/O interfacing concepts, memory mapped I/O, CISC Vs RISC design philosophy, von-neumann vs harvard architecture, MSP430x5x series block diagram, address space, on-chip peripherals (analog and digital) and register sets, instruction set, instruction formats and various addressing modes of 16-bit microcontroller. MSP430 specifics. Variants of the MSP430 family viz. MSP430x2x, MSP430x4x, MSP430x5x and their targeted applications, sample embedded system on MSP430 microcontroller.	8
II	**Peripherals And Programming For Microcontroller:** Memory mapped peripherals, programming system registers, I/O pin multiplexing, pull up/down registers, GPIO control, interrupts and interrupt programming, watchdog timer, system clocks, low power aspects of MSP430 - low power modes, active vs standby current consumption, FRAM vs flash for low power & reliability.	9

	Case Study: MSP430 based embedded system application bringing up the salient features of GPIO, watchdog timer, low power, FRAM. **Advance Topic:** Energy and power consumption estimation for embedded board.	
III	**Timers, PWM And Mixed Signals Peripherals:** Timer & real time clock (RTC), PWM control, timing generation and measurements. Analog interfacing and data acquisition - ADC and comparator in MSP430, data transfer using DMA. **Power Considerations:** Programming for optimal power consumption while using peripherals, using MSP430 peripheral intelligence in power management. **Case Study:** MSP430 based embedded system application using ADC & PWM demonstrating peripheral intelligence. Remote controller of air conditioner using MSP430	**8**
IV	**Embedded Communication, Networking And Internet Of Things:** Serial communication basics, synchronous/asynchronous interfaces (like UART, USB, SPI, and I2C), UART protocol, I2C protocol, SPI protocol, implementing and programming UART, I2C, SPI interface using MSP430, interfacing external devices.	**9**

Text Books:

1. ***Getting Started with the MSP430 Launch pad*** by Adrian Fernandez, Dung Dang, Newness publication ISBN-13: 978-0124115880
2. John H. Davies, ***MSP430 microcontroller basics,*** 1st Edition, Newnes Publication ISBN-13: 978-0750682763

Reference Books:

1. Manuel Jiménez, Rogelio Palomera, Isidoro Couvertier, ***Introduction to Embedded Systems: Using Microcontrollers and the MSP430,*** 2014th Edition, Springer ISBN-13: 978-1461431428
2. A Guide to Developing Embedded Systems D. Harres***MSP430-based Robot Applications***, 1st Edition, Newnes publication ISBN-13: 978-0123970121

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Other References:

1. Texas Instruments, ***Embedded Systems Design using MSP430***, (will be available online in downloadable pdf format)
2. http://processors.wiki.ti.com/index.php/MSP430_LaunchPad_Low_Power_Mode
3. http://processors.wiki.ti.com/index.php/MSP430_16-Bit_Ultra-Low_Power_MCU_Training

EC-511: POWER ELECTRONICS & EMMI LAB

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
0	0	2	1	30	20	50	3 hrs

Note: *The experiments may also be performed on simulation software. The lab practicals may be undertaken by two different faculty members corresponding to their respective subjects for two hours each.*

Practicals as per the topics in the syllabus for the course will be conducted in the laboratory. Following is the suggested list of practicals out of which a minimum of 8-10 experiments must be performed by a student during the semester.

LIST OF EXPERIMENTS

1. To study the characteristics of SCR, DIAC & TRIAC
2. To study the speed of a dc motor with the help of an SCR.
3. To determine frequency of a relaxation oscillator for various values of C.
4. Study of single phase AC to DC controlled converter (half controlled and full controlled).
5. With TPS7A4901 and TPS7A8300 or equivalent IC's, study:-
   (a) Impact of line and load conditions on drop out voltage
   (b) Impact of line and load conditions on efficiency
   (c) Impact of capacitor on PSRR
   (d) Impact of output capacitor on load-transient response
6. Study of DC-DC Buck converter:
   (a) Investigate how the efficiency of a TPS54160 buck regulator(or any other buck regulator IC) depends on the line and load conditions and on the switching frequency.
   (b) Analyze the influence of switching frequency fs and of capacitance C and resistance ESR of the input and output capacitors on steady-state waveforms of TPS54160 buck regulator (or any other equivalent IC).
7. With TPS55340 and LM5122 Boost regulatoror any equivalent IC's, study:-
   a) Impact of operating condition on operating mode.
   b) Impact of operating mode on efficiency.
   c) Impact of the operating condition and inductor characteristics on current limiting.
8. Simulation using Webench or equivalent software:-

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(a) Design a Low cost Boost Converter to derive 12V, 100mA from 5V USB
(b) Design a low cost and power efficient Buck Converter that could be used as a USB charger for mobile devices deriving its power from an automotive battery.
(c) Design a low cost synchronous buck converter.

9. Determination of Temp.-Resistance & Temp.-Voltage characteristics of the thermistor.
10. Determination of Temp.-Resistance & Temp.-Voltage characteristics of RTD (PT-100).
11. Determination of characteristics between strain applied & the voltage output, as well as the signal conditioned voltage of a cantilever strain gauge.
12. To study the characteristics of LVDT with respect to secondary output voltage & signal conditioned output voltage. Calibrate the LVDT & plot the graph between displacement & O/P voltage.
13. Measurement of unknown resistance using Kelvin's double bridge.
14. Measurement of unknown capacitance using Schering's bridge.
15. Measurement of unknown inductance using Anderson's bridge.

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EC-512: INTRODUCTION TO MICROCONTROLLERS FOR EMBEDDED SYSTEMS LAB

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
0	0	2	1	30	20	50	3 hrs

Practicals as per the topics in the syllabus for the course will be conducted in the laboratory. Following is the suggested list of practicals out of which a minimum of 8-10 experiments must be performed by a student during the semester.

List of Experiments

1. Interfacing and programming GPIO ports in C using MSP430 (blinking LEDs, push buttons).
2. Usage of Low Power Modes: Use MSPEXP430FR5969 as hardware platform and demonstrate the low power modes and measure the active mode and standby mode current of MSP430G2 launchpad.
3. Interrupt programming examples through GPIO's.
4. PWM generation using timer on MSP430 GPIO.
5. Interfacing potentiometer with MSP430.
6. PWM based speed control of motor controlled by potentiometer connected to MSP430 GPIO.
7. Using ULP advisor in code composer studio on MSP430.
8. Connect the MSP430 to terminal on PC and echo back the data.
9. Master slave communication between 2 MSP430s using SPI.
10. Enable energy trace and energy trace ++ modes in CCS.
11. Compute total energy, and estimated life time of a battery.

EC-513: MATLAB & ITS APPLICATIONS IN COMMUNICATION SYSTEMS

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
0	0	3	2	30	20	50	3 hrs

NOTE: All the experiments must to be performed on MATLAB.

Practicals as per the topics in the syllabus for the course will be conducted in the laboratory. Following is the suggested list of practicals out of which a minimum of 8-10 experiments must be performed by a student during the semester.

List of Experiments

13. To study the process of sampling &reconstruction from sampled signal.
14. To represent the histogram of Gaussian function.
15. To study the process of pulse amplitude modulation and determine its frequency spectrum.
16. To implement quantization and encode the obtained waveform to a digital sequence.
17. To study pulse position modulation.
18. To study unipolar Non Return-to-Zero (NRZ), Polar NRZ, Unipolar Return-to-Zero (RZ), Bipolar RZ& Manchester code.
19. To study waveforms of Amplitude Shift Keying (BASK).
20. To study waveforms of Binary Phase Shift Keying (BPSK).
21. To determine spectrum of QPSK and OQPSK.
22. To determine signal space representation of QPSK.
23. To determine signal space representation of any *M*-ary technique.
24. To obtain eye diagram for a system.

EC-508: BIOMEDICAL ENGINEERING

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
2	0	0	2	40	60	100	3hrs

COURSE OBJECTIVE:

With widespread use and requirements of medical instruments, this course gives knowledge of the principle of operation and design of biomedical instruments. It attempts to render a broad and modern account of biomedical instruments.

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**Introduction and Bioelectric Potentials:** Development of biomedical, specification of requirement, man instrumentation system, problems encountered in measuring a living system, anatomy and physiological (biochemical system, cardiovascular system, respiratory system, nervous system), resting and action potentials, propagation of action potential, overview of physiological potentials (EEG, ECG, EMG, EOG, ERG, EGG).	8
II	**Transducers:** Transducers and transducer principles, active transducers (magnetic induction, thermoelectric effect, piezoelectric effect)**,** passive transducers (using resistive elements, inductive elements, active circuit elements, capacitive elements) force transducers, pressure transducers, pulse sensors, respiration sensor, transducers with digital output	9
III	**Electrodes:** Electrode theory, biopotential electrodes (microelectrodes, body surface electrodes, needle electrodes), biochemical electrodes (reference electrodes, the ph electrode, blood gas electrode**),** elements of intensive care monitoring, patient monitoring displays, diagnosis, calibration of patient monitoring equipment, pacemakers, defibrillators.	8
IV	**General Topics:** Body temperature (heat production and heat loss,	9

	temperature regulating mechanisms, afferents, fever), laser applications in medical field, diathermy (applications related to physiotherapy, short wave diathermy, microwave diathermy), clinical laboratory instruments (spectrophotometers, chromatology, hematology), stimulators (transcutaneous electrical nerve stimulator, muscle stimulator, spinal cord stimulator, bladder stimulator)	

Text Books:

1. Dr. O.N. Pandey, ***Fundamentals of Biomedical Instrumentation***, S.K. Kataria& Sons.
2. R.S. Khandpur, ***Handbook of Biomedical Instrumentation***, 3rd Edition, Tata McGraw Hill.

Reference Books:

1. John G.Webster, ***MedicalInstrumentation: Application and Design***, 3e Wiley
2. Leslie Cromwell, Fred J. Weibell, Erich A. Pfeiffer, ***Biomedical Instrumentation and Measurements***, 2nd Edition , Pearson.

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EC-509: MICROPROCESSORS & PERIPHERALS

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
2	0	0	2	40	60	100	3 hrs

COURSE OBJECTIVE:

To study the working of 8085 microprocessor, its architecture, I/O interface, peripherals and assembly language programming. Understanding of 8086 architecture will provide better understanding of the next generation microprocessors.

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	Introduction, evolution of microprocessor, 8085 microprocessor - features, architecture and pin configuration. 8085 instruction - instruction word size, opcode format, data format, addressing modes, 8085 machine cycles and timing diagrams.	8
II	**Programming:** Assembly language program - addition, subtraction, Data transfer and data shift programs. **Interrupts & data transfer:** Interrupt system of 8085, stack and subroutine.	9
III	**I/O interfacing:** Basic interfacing concept using mapping techniques - I/O mapped I/O and memory mapped I/O. **Serial I/O:** Basic concepts in serial I/O, asynchronous serial data communication using SOD and SID. **Peripheral Devices & Applications Of Microprocessor:** Description of the 8251 programmable communication interface, 8255 programmable peripheral interface.	8
IV	**Trends in Microprocessor:** 8086 microprocessor- main features, architecture-the execution unit and bus interface unit, memory	9

	segmentation, memory addressing, 8086 hardware pin signals, 8086 minimum and maximum modes of operation.	

Text Books:

1. Gaonkar, ***Microprocessor Architecture, programming and application with 8085***, PHI.
2. D.V. HALL, ***Microprocessors and Interfacing***, McGraw Hill.
3. Senthil, Saravanam, ***Microprocessor and Microcontrollers***, Oxford University Press.

Reference Books:

1. ***An introduction to microprocessor***, A.P. Mathur, TMH.
2. Kenneth J Ayala, ***The 8086 Microprocessor***, Cengage Learning
3. B.Ram, ***Fundamentals of microprocessor & microcomputers***, Dhanpat Rai & Co.

EC-510: OPTICAL COMMUNICATION

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
2	0	0	2	40	60	100	3 hrs

COURSE OBJECTIVE:

Optical communication is the most modern and advanced form of broadband communication. It has undergone an unprecedented growth since its inception in 1960s. Many advanced technologies including doped fiber amplifiers, various optical components and optical sensors have been evolved. The course covers from the basics to most advanced technologies employed in optical communication. The prerequisite for the course are the basics of electromagnetic waves and communication systems.

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**Overview of Optical Fiber Communication System:** Evolution of fiber optic system, advantages/disadvantages of optical fiber communication, elements of an optical fiber transmission link. **Optical Fiber: Structure And Wave Guiding:** Polarization, diffraction, reflection and refraction, total internal reflection, acceptance angle, numerical aperture, waveguides, light propagation in optical fiber, ray theory, mode theory, types of optical fiber, mode field diameter, cut off wavelength.	8
II	**Signal Degradation in Optical Fiber:** Linear effect in optical fiber-attenuation, dispersion and their types, non-linear effects of fiber – index related and scattering related. **Optical Sources:** Semiconductor fundamentals, light emitting diodes, laser diodes, optical transmitter.	9
III	**Optical Receiver:** Photo diodes, types of photo diodes, photo detector	8

	noise, optical receivers. **Optical Transmission System- Concept And Components:** Point to point links, power budgeting, rise time budgeting, multichannel concept, WDM components, system performance parameters.	
IV	**Optical Amplifiers:** Basic applications of optical amplifiers, types of optical amplifier, semiconductor optical amplifiers, erbium doped fiber amplifier, raman amplifier. **Optical Components:** Coupler/splitter, optical switches, optical add/drop multiplexers, fiber grating, optical sensors and their types.	**9**

Text Books:

1. Gred Keiser, ***Optical Fiber Communication***, Mc- Graw Hill Publication.
2. Ajay Kashyap, Ashish Sharma, ***Optical Fiber Communication Engineering***, PBS Publications.
3. John Senior, ***Optical Fiber Communication***, Prentice Hall of India Publication
4. Djafar K. Mynbarv, Lowell L. Scheiner, ***Fiber Optic Communication***, Pearson Education.

Reference Books:

1. Agrawal, ***Fiber Optic Communication***, Wiley
2. Khare, ***Fiber optics and Optoelectronics***, Oxford University Press
3. Selvarajan, Subartkar, T. Srinivas, ***Optical Fiber Communication***, Tata Mc- Graw Hill Publication.

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SEMESTER-VI

EC-601: ADVANCED MICROCONTROLLERS FOR EMBEDDED SYSTEMS

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
3	0	0	3	40	60	100	3hrs

COURSE OBJECTIVE:

This course covers the broad range of foundational skills that apply across all embedded computer system application areas. The emphasis is at the layer where hardware meets software.Topics include microcontroller hardware, Tiva based embedded system, embedded network and internet of things. Real world engineering practices, constraints, and example applications are integrated throughout the course.

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**Introduction To Embedded Systems:** Instruction set, instruction formats and various addressing modes of 32-bit. Fixed point and floating point arithmetic operations, introduction ARM architecture and cortex – M series, introduction to the tiva family viz. TM4C123x & TM4C129x and its targeted applications, tiva block diagram, address space, on-chip peripherals (analog and digital) register sets, addressing modes and instruction set basics.	8
II	**Microcontroller Fundamentals For Basic Programming:** I/O pin multiplexing, pull up/down registers, GPIO control, memory mapped peripherals, programming system registers, watchdog timer, need of low power for embedded systems, system clocks and control, hibernation module on tiva, active vs standby current consumption. Introduction to interrupts, interrupt vector table, interrupt programming.	9

	Timer, basic timer, real time clock (RTC), timing generation and measurements, analog interfacing and data acquisition - ADC, analog comparators, DMA, motion control peripherals - PWM module & quadrature encoder interface (QEI). **Case Study:** Tiva based embedded system application bringing up the salient features of GPIO, Watchdog timer, etc. **Case Study:** Tiva based embedded system application using ADC & PWM.	
III	**Communication Protocols And Interfacing With External devices:** Synchronous/asynchronous interfaces (like UART, SPI, I2C, USB), serial communication basics, baud rate concepts, interfacing digital and analog external device, I2C protocol, SPI protocol & UART protocol. Implementing and programming I2C, SPI & UART interface using Tiva. CAN & USB interfaces on Tiva platform. **Case Study:** Tiva based embedded system application using the interface protocols for communication with external devices - Sensor hub booster pack.	**8**
IV	**Embedded networking and Internet of Things:** Embedded networking fundamentals, ethernet, TCP/IP introduction IoT overview and architecture, overview of wireless sensor networks and design examples. Various wireless protocols and its applications - NFC, ZigBee, bluetooth, bluetooth low energy, Wi-Fi. adding Wi-Fi capability to the microcontroller, embedded Wi-Fi, user APIs for wireless and networking applications, building IoT applications using CC3100 user API - connecting sensor devices using tivaware sensor library. **Case Study:** Tiva based embedded networking application - Smart plug with remote disconnect and Wi-Fi connectivity.	**9**

Text Books:

1. ***Embedded Systems: Real-Time Interfacing to ARM Cortex-M Microcontrollers***, 2014, Createspace publications ISBN: 978-1463590154.
2. Jonathan W Valvano, ***Embedded Systems: Introduction to ARM Cortex - M Microcontrollers***, 5th edition Createspace publications ISBN-13: 978-1477508992.

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Reference Books:

1. ***ARM System Developer's Guide: Designing and Optimizing System Software*** ELSEVIER INDIA; First edition, ISBN-13: 978-8181476463

Other References:

1. Texas Instruments, ***Embedded System Design using TIVA*** (will be available online in downloadable pdf format)
2. http://processors.wiki.ti.com/index.php/Hands-On_Training_for_TI_Embedded_Processors
3. http://processors.wiki.ti.com/index.php/MCU_Day_Internet_of_Things_2013_Workshop
4. http://www.ti.com/ww/en/simplelink_embedded_wi-fi/home.html

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EC-602: ANTENNA & WAVE PROPAGATION

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
3	0	0	3	40	60	100	3hrs

COURSE OBJECTIVE:

To study the basics of antenna which will enable student to evaluate different types antennas used in the communication systems. Moreover the theoretical aspect will make them have better understanding of the creation of electromagnetic fields from the antenna structure. Study of propagation in various mediums will help them in understanding the basics of wave propogation.

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**Antenna Basics:** Introduction, definition of antenna, applications of antennas, network theorems, properties of antenna, antenna parameters: radiation pattern, radiation power density, radiation intensity, directivity, gain, antenna efficiency, beam efficiency, bandwidth, polarization, input impedance, effective length and equivalent area, antenna temperature; basic antenna elements, radiation mechanism, radiated power and radiation resistance of current element, hertizian dipole, radiation from half wave dipole, radiation from quarter wave monopole.	8
II	**Analysis And Synthesis Of Linear Arrays:** Introduction, point source, array of two isotropic point sources, non- isotropic but similar point sources, principle of pattern multiplication, linear arrays of n isotropic point sources of equal amplitude and spacing, analysis of broadside arrays, end-fire array, n-element linear array with non-uniform spacing. **HF, VHF and UHF antennas:** Isotropic radiators, directional antennas, omni-directional antenna, resonant antennas, travelling wave antennas, folded dipole, v-antenna, rhombic antenna, yagi-uda antenna, log periodic antennas, loop antenna, helical antenna, ferrite rod antenna, turnsentile	9

	antenna.	
III	**Microwave Antennas:** Rod reflector, plane reflector, corner reflector, parabolic reflector and its types, feed systems for parabolic reflectors, horn antenna, corrugated horns, slot antenna and its impedance, babinet's principle, microstrip or patch antennas. **Smart Antennas:** Smart antenna analogy, cellular radio systems evolution, signal propagation, smart antennas benefits, smart antennas drawbacks, antenna beam forming, mobile Ad-hoc networks(MANETs)	**8**
IV	**Wave Propagation:** Propagation characteristics of EM wave with factors, ground wave and its field strength, reflections of radio waves by the surface of the earth, roughness of earth, reflection factors of earth, wave tilt of ground wave, space wave or tropospheric wave propagation, effect of curvature of the earth/earth's imperfections and roughness/hills buildings and other obstacles/height above the earth/polarization, duct propagation, troposcatter, ionospheric wave propagation, ionospheric abnormalities, ionospheric storms, sudden ionospheric disturbances (SID), sun spot cycle, critical frequency, MUF, LUF, virtual height and skip distance, relation between muf and skip distance, whistlers, effect of earth's magnetic field.	**9**

Text Books:

1. G.S.N. Raju, ***Antenna and Wave Propagation***, Pearson Publication.
2. C.A. Balanis, ***Antenna Theory Analysis and Design,*** John Wiley & sons.
3. J.D. Krauss, ***Antennas and Wave Propagation***, Tata Mc-Graw Hill Company.

Reference Books:

1. Rajeshwari Chaterjee, ***Antenna Theory and Practice***, New Age International Publishers.
2. A.R. Harish, ***Antenna & Wave Propagation***, Oxford University Press.
3. S K Das, ***Antenna & Wave Propagation***, Tata Mc-Graw Hill Company.

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EC-603: CONTROL SYSTEMS

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
3	1	0	4	40	60	100	3hrs

COURSE OBJECTIVE:

To understand fundamental concepts of control system and understand need of control engineering in design & stability analysis of control engineering systems. To study mathematical modeling of various physical control systems.

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**Introduction:** Concepts of control systems, general schematic diagram of control system, open loop and closed loop control systems and their differences, feed-back characteristics, effects of feedback. Mathematical models – differential equations. **Mathematical Modeling:** Mathematical modeling of electrical, mechanical and thermal systems. Review of laplace transform.	8
II	**Transfer Function Representation:** Transfer function of linear systems, block diagram representation of systems and their reduction, representation by signal flow graph - reduction using mason's gain formula. **Time Response Analysis:** Standard test signals, time response of first order systems, characteristic equation of feedback control systems, transient response of second order systems, time domain specifications, steady state response, steady state errors and error constants.	9
III	**Stability Analysis:** Definitions, routh-hurwitz criterion, limitations of routh's stability, root locus technique: the root locus concept, construction of root loci, effects of adding poles and zeros on the root loci in terms of stability.	8

	Frequency Response Analysis: Introduction, frequency domain specifications -bode plots, determination of transfer function from the bode plots, phase margin and gain margin, stability analysis from bode plots, polar plots, nyquist plots.	
IV	**Classical control design techniques:** Compensation techniques – lag, lead, lead -lag controllers' design in frequency domain, PID controllers **State Variable Analysis:** Concepts of state, state variables and state model, derivation of state models from block diagrams, solutions of time invariant state equations- State transition matrix and its properties, concepts of controllability and observability.	**9**

Text Books:

1. B S Manke, ***Linear Control Systems with MATLAB applications***, Khanna Publications.
2. B. C. Kuo, ***Automatic Control Systems,*** John Wiley and sons.
3. I. J. Nagrath and M. Gopal, ***Control Systems Engineering***, New Age International (P) Limited, Publishers.

Reference Books:

1. K. Ogata, ***Discrete time Control Systems,*** Prentice Hall International.
2. Warwick, Kevin, ***An Introduction to Control Systems***, World Scientific Publishing Co. Ptv. Ltd.
3. Levine, ***Control System Fundamentals,*** W. S- CRC Press.

EC-604: DIGITAL SIGNAL PROCESSING

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
3	1	0	4	40	60	100	3 hrs

COURSE OBJECTIVE:

To introduce the techniques of modern digital signal processing that are fundamental to a wide variety of application areas. Special emphasis is placed on the architectures and design techniques for digital filters.

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**Discrete-Time Signals And Systems:** Basic elements of a digital signal processing system, advantages of digital signal processing, classification of signals, discrete-time systems described by difference equations, linear constant coefficient of difference equation, convolution sum, circular convolution and correlation of signals. **Discrete-time Fourier transform:** The fourier transform of discrete-time signals (DTFT), properties of the DTFT.	**8**
II	**Discrete Fourier transform (DFT):** DFT, properties of the DFT, IDFT, fast fourier transform (FFT) - decimation-in-time (DIT) algorithm-decimation-in-frequency algorithm-FFT, Radix-2 DIT and DIF implementation. **Effect Of Finite Word Length In Digital Filters:** Introduction, rounding and truncation errors, quantization effect in analog-digital-conversion of signals, output noise power from digital system.	**9**
III	**Digital filter design:** General considerations, review of analog filter design, design of iir digital filters - IIR digital filter design using the impulse invariance method and the bilinear transformation method, butter	**8**

	worth and chebyshev filter. **Digital Filter Structures:** Digital filter categories, realization structures for FIR & IIR digital filters, implementation of digital filters - direct form-I, direct form-II, structures for FIR and IIR filters.	
IV	**Design Of Linear Phase FIR Digital Filters:** FIR digital filter design using the windows method and the frequency-sampling method. **Multirate Digital Signal Processing:** Introduction, advantages of multirate dsp, decimation, time-domain characterization, frequency-domain characterization, aliasing effect, anti-aliasing filter specifications, interpolation, application of multirate DSP.	**9**

Text Books:

1. John G. Proakis & Dimitris G. Manolakis, ***Digital Signal Processing: Principles, Algorithms and Applications,*** Pearson Education.
2. Sanjit K. Mitra, ***Digital Signal Processing***, Tata McGraw Hill Publication.
3. Tarun kumar Rawat, ***Digital Signal Processing***, OXFORD university press.

Reference Books:

1. Farooq Hussain, ***DigitalSignal and Processing***, Prentice Hall.
2. S. Salivahanan, A. Vallavaraj,***Digital Signal Processing***, Tata McGraw-Hill Education.
3. Dr. Sanjay Sharma, ***Digital Signal Processing***, S.K. Kataria & Sons.

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EC-605: MICROELECTRONICS TECHNOLOGY

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
2	2	0	3	40	60	100	3hrs

COURSE OBJECTIVE:

To study the manufacturing process of integrated circuits.To provide insight to chemical vapor deposition technique, epitaxial growth, oxidation and diffusion process, ion implantation, lithography, plasma deposition, etching and metallization.

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	Clean room concept, growth of single crystal silicon - czochralski and float zone method, wafer processing, cleaning and etching. **Physical vapour deposition:** Vacuum evaporation sputtering. **Chemical vapour deposition:** APCVD, plasma CVD, MOCVD.	8
II	**Epitaxial growth:** Liquid phase epitaxy, vapour phase epitaxy, molecular beam epitaxy, hetero epitaxy. **Oxidation:** Growth mechanism and kinetics of oxidation, oxidation techniques and systems, oxide properties, oxide induced defects. **Diffusion:** Fick's equations, atomic diffusion mechanisms, measurement techniques, diffusion in polysilicon and sio_2, diffusion systems.	9
III	**Ion Implantation:** Range Theory, Equipments, Annealing, Shallow Junction, High Energy Implantation. **Lithography:** Optical lithography, optical mask printing and making techniques, electron lithography, x-ray lithography.	8

	Plasma Deposition And Etching: Plasma properties, plasma assisted depositions of polysilicon, silicondioxide and silicon nitrides, reactive plasma etching techniques and equipment, specific etch processes.	
IV	**Metallisation:** Metallisation application, patterning interconnects, multilayer metallisation, measurement. **VLSI Process Integration:** Fundamental considerations of IC technology, NMOS and CMOS IC processing, MOS Memory IC processing, Bi-CMOS processing.	**9**

Text Books:

1. S.M. Sze,***VLSI Technology***, McGraw-Hill Int. Ed
2. S.K. Ghandhi, John Wiley Inc., ***VLSI Fabrication Principles***, New York, 1983.2

Reference Books:

1. James Plummer, M. Deal and P. Griffin, ***Silicon VLSI Technology***, Prentice Hall Electronics and VLSI series.
2. Stephen Campbell, ***The Science and Engineering of Microelectronics***, Oxford University Press.
3. D. Nag Choudhury, ***Principles of Microelectronics Technology***, Wheeler Publishing house.

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EC-606: WIRELESS & MOBILE COMMUNICATION

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
3	0	0	3	40	60	100	3 hrs

COURSE OBJECTIVE:

To provide an overview of wireless communication networks & its application in communication engineering and to understand the various terminology, principles, devices, schemes, concepts and different methodologies used in wireless networks.

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**Fundamentals Of Wireless Communication:** Introduction to wireless communication, cellular concept, system design fundamentals, wireless communication channel specification, types of wireless communication system. Coverage and capacity improvement in cellular system–splitting and sectoring, technical challenges.	8
II	Mobile radio propagation, reflection, diffraction, fading, multipath propagation, statistical characterization of multipath fading, diversity techniques. Path loss prediction over hilly terrain, practical link budget design using path loss models, design parameters at base station, antenna location, spacing, heights and configurations.	9
III	**Wireless Adhoc Networks:** Wireless adhoc networks, mobile adhoc networks (MANETS), wireless sensor network, wireless mesh network, vehicular ad hoc networks (VANETS). **Wireless Communication Systems GSM:** Global system for mobile	8

	(GSM)- services and features, GSM architecture and interfaces, GSM radio sub system, GSM channel types - traffic channels, control channels, example of a GSM call, GPRS.	
IV	Spread spectrum, multiple access techniques; frequency division multiple access (FDMA), time division multiple access (TDMA) and code division multiple access (CDMA), power control, wideband code division multiple access (WCDMA), CDMA network design, orthogonal frequency division multiple access (OFDMA) and multi-carrier code division multiple Access (MC-CDMA). GSM.3G,4G long term evolution(LTE), near field communication (NFC) systems, wireless local area network (WLAN) technology, wireless local loop (WLL), hyper local area network (HLAN).	**9**

Text Books:

1. T.S. Rappaport, ***Wireless Communication Principles***, Pearson.
2. A.F. Molisch, ***Wireless Communications***, John Wiley Inc.

Reference Books:

1. P. Muthu Chidambara Nathan***, Wireless Communications***, PHI.
2. W. C. Y. Lee, ***Mobile Communication Engineering,*** McGraw- Hill.
3. A. Goldsmith***, Wireless Communications***, Cambridge University Press.
4. S. G. Glisic, ***Adaptive CDMA***, John Wiley Inc.

EC-611: ADVANCED MICROCONTROLLERS FOR EMBEDDED SYSTEMS LAB

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
0	0	2	1	30	20	50	3 hrs

Practicals as per the topics in the syllabus for the course will be conducted in the laboratory. Following is the suggested list of practicals out of which a minimum of 8-10 experiments must be performed by a student during the semester.

List of Experiments

1. Interfacing and programming GPIO ports in C using Tiva (blinking LEDs, push buttons).
2. Interrupt programming examples through GPIOs.
3. Use hibernation mode and wake on RTC interrupt.
4. PWM generation using PWM Module on Tiva
5. Interfacing using in-build peripherals:

a. Interfacing potentiometer with Tiva GPIO.

b. PWM based speed control of motor controlled by potentiometer connected to Tiva GPIO.

6. Connect the Tiva to terminal on PC and echo back the data using UART.
7. Interfacing an accelerometer with Tiva using I2C.
8. Experiment on USB (Sending data back and forth across a bulk transfer-mode USB connection).
9. Using IQ math library for implementing low pass FIR filter.
10. Review of User APIs for TI CC3100 & Initialization and setting of IP addresses .
11. A basic Wi-Fi application– communication between two Tiva based sensor nodes using TIVA sensor library in Tivaware.
12. Setting up the CC3100 as a HTTP server.

EC-612: DIGITAL SIGNAL PROCESSING LAB

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration End Semester Examination
L	**T**	**P/D**	**C**	**Sessional**	**End Semester Exam**	**Total**	
0	0	2	1	30	20	50	3 hrs

Note: All the experiments should be performed on MATLAB software.

Practicals as per the topics in the syllabus for the course will be conducted in the laboratory. Following is the suggested list of practicals out of which a minimum of 8-10 experiments must be performed by a student during the semester.

List of Experiments

1. To illustrate simple mathematical expressions in MATLAB.
2. To represent basic signals (unit step, unit pulse, ramp, sine, cosine)
3. To develop a program for discrete convolution.
4. To develop a program for discrete correlation.
5. To develop a program for circular convolution of the sequence.
6. Implementation of decimation process.
7. Implementation of interpolation process.
8. To find DFT / IDFT of given DT signal.
9. To find the FFT of the sequence.
10. Implementation of LP FIR filter for a given sequence.
11. Implementation of HP FIR filter for a given sequence.
12. Implementation of LP IIR filter for a given sequence.
13. Implementation of HP IIR filter for a given sequence.

EC- 613: SEMINAR

Evaluation Scheme:

Teaching Scheme			Credits	Marks			Duration of End Semester Evaluation
L	T	P/D	C	Sessional	End Semester Evaluation/ Viva	Total	
0	0	2	1	50	50	100	-

OBJECTIVE:

To measure as well as flourish the ability of the student to study a topic, in Electronics and Communication Engineering, of current relevance, from technical literature and present a seminar on that topic.

PROCEDURE:

Individual students should be asked to choose a topic in any field of Electronics and Communication Engineering, preferably from outside the B.Tech syllabus and give a seminar on that topic for about thirty minutes. It enables the students to gain knowledge in any of the technically relevant current topics and acquire the confidence in presenting the topic. The student will undertake a detailed study on the chosen topic under the supervision of a faculty member, by referring papers published in reputed journals and conferences. Each student has to submit a seminar report (in two copies), based on these papers; the report must not be reproduction of any original paper. A committee consisting of three/four faculty members (preferably specialized invarious sub-fields of Electronics and Communication Engineering) will evaluate the seminar. One of the two copies submitted by the student should be returned to him/her after duly certifying it by the staff in charge of the seminar and Head of the department and the other copy shall be kept in the departmental library.

Internal Continuous Assessment
As per ordinance

EC-608: TV ENGINEEGING

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
3	0	0	3	40	60	100	3 hrs

COURSE OBJECTIVE:

Course discusses component and system concepts in television systems and video engineering and comprehensive coverage of television systems with all the new developments in television. Understanding of colour television systems and basics of television transmission and receiving system is also undertaken.

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**Fundamentals of Television:** Introduction, audio and video transmission, aspect ratio, image continuity, number of scanning lines, interlaced scanning, picture resolution, video bandwidth. **Composite video signal:** Video signal, composite video signal, horizontal synchronization, vertical synchronization, functions of vertical pulse train, scanning sequence, picture signal transmission, vestigial side band transmission, sound signal transmission, standard channel bandwidth.	8
ii	**Television Camera Tubes:** Basic principle, image orthicon, vidicon, plumbicon, silicon diode array vidicon. **Basic Television Transmission And Reception:** Television cameras, programme control room, video switcher, synchronization system, generation of amplitude modulation, television transmitter, positive and negative modulation, sound signal transmission, generation of frequency modulation, merits of frequency modulation, classification of TV	9

	receivers, vestigial sideband correction, choice of intermediate frequencies, picture tube circuits, sound signal separation, sound section, automatic frequency control circuit, horizontal and vertical deflection circuits.	
III	**Color Television Essentials:** Compatibility, color perception, three color theory, luminance, hue, saturation, color TV camera, values of color difference signals on colors, color TV display monitors, delta gun and precision-in-line color picture tube, purity and convergence and their adjustments, trintron color picture tube, pincushion correction techniques, automatic degaussing circuit, grey scale tracking.	**8**
IV	**Color Television Systems:** NTSC color TV systems, SECAM system, PAL color TV systems, cancellation of phase errors, merits and demerits of each system. **Advanced Television Systems:** Broadcast system, cable TV, cable signal sources, cable signal processing, distribution and scrambling, video domestic formats, tele text signal coding and broadcast receiver, digital television:transmission and reception,projection television,flat panel display T V receivers, LCD and plasma screen receivers, 3D-TV basics, ED-TV.	**9**

Text Books:

1. R.R.Gulati, ***Monochrome Television Practice, Principles, Technology and servicing,*** New age international.
2. A. M Dhake, ***Television and Video Engineering***, Tata McGraw-Hill.

Reference Books:

1. R. P. Bali, ***Color Television, Theory and Practice,*** Tata McGraw-Hill.
2. Jerry Whitaker, ***Mastering Digital Television***, McGraw-Hill.

EC- 609: PRINCIPLES OF SOFT COMPUTING

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
3	0	0	3	40	60	100	3 hrs

COURSE OBJECTIVE:

The main objective of the course is to expose the students to soft computing and various types of soft computing techniques. Upon completion of this course, the student will be able to get an idea on artificial neural networks and fuzzy logic which have their roots in artificial intelligence.

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**Artificial Neural Network an Introduction:** Fundamental concept, evolution of neural networks, basic models of artificial neural network, important terminologies of ANNs - weights, bias, threshold, learning rate, momentum factor, vigilance parameter, notations, linear seperability, Hebb network. **Supervised Learning Network :** Perceptron networks - theory, perceptron learning rule, architecture, flowchart for training process, perceptron training algorithm for single output classes, perceptron training algorithm for multiple output classes, perceptron network testing algorithm, adaptive linear neuron (Adeline), multiple adaptive linear neurons, back propagation network, radial basis function network.	8
II	**Introduction to Fuzzy Logic, Classical sets and Fuzzy sets:** Introduction to fuzzy logic, classical sets (crisp sets), operation of classical sets, union, intersection and difference, properties and function mapping of classical sets, fuzzy set operations, properties of fuzzy set.	9
III	**Basic Combinational Circuits Design:** Combinational gates, multiplexer,	9

	decoder, code converter, equality checker, comparator with single output, comparator with multiple outputs. **Basic Sequential Circuit:** Flip-flops, latches, counters, shift register, parallel to serial converter, serial to parallel converter.	
IV	**Classical Relation and Fuzzy Relation:** Cartesian product of relation and classical relation, fuzzy relations, tolerance and equivalence relations. Membership function - introduction and features of membership function, defuzzification. Fuzzy arithmetic and fuzzy measures - introduction, fuzzy arithmetic, fuzzy measure, belief and plausibility measures, probability measures, possibility and necessity measures, Fuzzy rule base and approximate reasoning - introduction, truth values and table in fuzzy logic formation of rules, decomposition of rules (compound rule).	**8**

Text Books:

1. S.N Shivanandan and S.N Deepa,***Principles of Soft Computing,*** Wiley.
2. S. Rajasekaran, G.A. Vijayalakshmi Pai,***Neural Networks, Fuzzy Logic and Genetic Algorithms - Systems and Applications,*** PHI
3. A.M.Law and W.David Kelton,***Simulation Modeling and Analysis,*** McGraw Hill Inc.,

Reference Books:

1. M.C.Jeruchim,***Simulation of Communication Systems***, Plenum Press, New York.
2. Jerry Banks,***The Art of Computer Systems Performance Analysis***, Wiley.

EC-610: RELIABILITY ENGINEERING

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
3	0	0	3	40	60	100	3 hrs

COURSE OBJECTIVE:

The course will provide an introduction to reliability fundamentals. Reliability for simple and complex systems and the relationship to component reliability will be discussed.

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**Reliability Fundamentals:** Introduction, importance of reliability, reliability functions, failure and failure modes, causes of failure, instantaneous failure rate, general reliability function. **Component Reliability And Hazard Model:** Component reliability from test data, failure data (Failure density, failure rate, reliability, probability of failure) mean failure rate MTTF, MTBF.	8
II	**System Reliability:** Reliability evaluation of non-maintained systems, series, parallel, series-parallel, non-series, standby configuration, k out of n configuration, complex system, markov's method, fault tree technique, event space, path tracing methods, cut-set and tie set method. **Hazard Model:** Hazard models (time dependent hazard models, constant hazard model, linear hazard model, on-linear hazard model	9
III	**Reliability Improvement:** introduction, improvement of components, redundancy - standby with perfect and imperfect switching, comparison of component redundancy to system/unit redundancy, mixed redundancy, stand by redundancy.	8

	Reliability Allocation: introduction, redundancy allocation and techniques for reliability allocation.	
IV	**Availability:** Concepts of reliability, availability and maintainability, types of availability. **Maintainability:** Objectives of maintenance, classification and factor effecting maintenance, maintenance levels, inventory control of spare parts, preventive maintenance of some electrical appliances.	**9**

Text Books:

1. K. Govil, ***Reliability Engineering***, Tata McGraw Hill.
2. Dan W. Patterson, ***Introduction to Artificial Intelligence and Expert Systems***, Prentice Hall.
3. E. Balagurusamy, ***Reliability Engineering***, Tata McGraw Hill.
4. Elaine Rich, Kevin Knight, ***Artificial Intelligence***, Tata McGraw Hill.
5. K. K. Aggarwal***, Reliability Engineering***, Kluwer academic publications.

Reference Books:

1. D. W. Rolston, ***Principles of Artificial Intelligence and Expert Systems Development***, Tata McGraw-Hill.
2. G. F. Luger, ***Artificial Intelligence- Structures and strategies for complex problem solving***, Pearson.

SEMESTER-VII

EC-701: COMPUTER NETWORKS & DATA COMMUNICATION

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
3	0	0	3	40	60	100	3 hrs

COURSE OBJECTIVE:

Internet has become one of the most important components of our life. This course introduces students to computer networks. It also helps students in understanding the procedure of transmitting data over the network and how to resolve the conflicting issues arising in the course of transmission. The course provides an introduction to hardware, software, terminology, components, design, and connections of a network. Network concepts such as the OSI model and TCP/IP protocols are also included.

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**Introduction:** Components of data communication, data representation, data flow, network criteria, physical structures of networks, Network types - local area network, metropolitan area network, wide area network.Internet and its standards. **Switching:** Circuit switching, packet switching. **Network Models:** TCP/IP protocol suite-layered architecture, encapsulation and decapsulation, addressing. The OSI model, OSI versus TCP/IP, lack of OSI model's success.	8
II	**Introduction to Physical Layer:** Data and signals, Transmission impairment - attenuation, distortion, noise, Data rate limits -noiseless channel, noisy channel, using both limits. Performance-bandwidth, throughput, latency (delay), bandwidth-delay product, jitter. **Digital Transmission:** Digital-to-digital conversion -line coding and its	9

	schemes, block coding. **Error Detection:** Types of errors, redundancy, coding, Block coding- error detection. Cyclic coding - cyclic redundancy check, cyclic code analysis, advantages of cyclic coding.	
III	**Error Correction:** Detection versus correction, Forward error correction- using Hamming distance using XOR, chunk interleaving, combining Hamming distance and interleaving. **Transmission Networks:** PDH networks, SONET/SDH networks, DWDM networks. **Ethernet:** Ethernet evolution, Standard Ethernet -characteristics, addressing, access method, efficiency, implementation. Fast Ethernet- access method, physical layer.	**9**
IV	**Wireless LANs:** Architectural comparison, characteristics, IEEE 802.11 - architecture, Mac sub-layer, addressing mechanism. Personal area networks -bluetooth architecture, bluetooth layers, zigbee architecture and layers, comparison of bluetooth and zigbee. **Network Layer:** Network layer services, Packet switching -datagram approach, virtual circuit approach. IPV4 addressing-address space, classful addressing, classless addressing. **Other Wired and Wireless Networks:** SONET -architecture, SONET layers, SONET frames, STS multiplexing. ATM -design goals, problems, architecture. WiMAX-services, IEEE project 802.16, layers in 802.16.	**8**

Text Books:

1. Forauzan,***Data Communications and Networking***, TMH publication.
2. Tenanbaum, ***Computer Networks***, PHI publications.

Reference Books:

1. William Stallings,***Data and Computer Communications,*** Pearson publication.
2. Curl M. White,***Data Communications and Computer Networks,*** Cengage Learning.

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EC-702: MICROWAVE AND RADAR ENGINEERING

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
3	1	0	4	40	60	100	3 hrs

COURSE OBJECTIVE:

The students will be able to understand the theoretical principles underlying microwaves, waveguides and transmission lines. They will develop the ability to identify and study the performance of wave guides and resonators. They will acquire knowledge about radar and radar equations and develop the understanding of the working principal of CW, MTI and pulse Doppler radar.

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**Microwave Transmission Lines:** Transmission line equations and solutions, reflection coefficient and transmission coefficient, standing wave ratio, line impedance and admittance, smith chart, Impedance matching – quarter wavelength matching, single stub matching and double stub matching using smith charts. **Waveguides:** Classification of guided wave solutions-TE, TM and TEM waves (rectangular and circular). Wave propagation in the waveguide, power transmission and attenuation, waveguide resonators.	8
II	**Klystrons:**Limitations of conventional vacuum tubes, Klystrons -reentrant cavities, two cavity klystron, velocity modulation process, bunching process, power output and efficiency, multi-cavityklystron, reflex klystron. **Travelling Wave Tubes**: Slow-wave structures, Helix TWT- amplification process, convectioncurrent, wave modes and gain. Coupled cavity TWT, backward wave oscillator.	9

	Crossed Field Devices: Magnetrons- principle of operation, characteristics, hull cut-off condition.	
III	**Microwave Transistors and FETs**: Microwave bipolar transistors-physical structures,characteristics, power-frequency limitations.Microwave tunnel diode, Microwave unipolar transistor – physical structure, principle of operation, characteristics.High electron-mobilitytransistors. **Transferred Electron and Avalanche Transit-time Devices**: Gunn diode, Gunn diode as anoscillator, IMPATT, TRAPATT and BARITT.	**9**
IV	**Introduction to Radar System:** Simple form of radar equation, radar block diagram and operation, radar frequencies and applications. **Types of Radar**: CW, MTI and Pulse Doppler radar, Doppler effect, prediction of range performance, minimum detectable signal, receiver noise and transmitter power.	**8**

Text Books:

1. S.Y.Liao, ***Microwave Devices and Circuits***, PHI.
2. R. F. Soohoo, ***Microwave Electronics***, Wesley publication.
3. Peyton Z. Peebles,***Radar Principles***, Wiley India Edition.

Reference Books:

1. R.E.Collin, ***Foundations for Microwave Engineering***,Wiley India.
2. D.M.Pozar, ***Microwave Engineering,*** Wiley India.
3. K C Gupta, ***Microwaves***, Wiley Eastern Limited.
4. Merrill I. Skolnik,***Introduction to Radar system***, TMH.

EC-703: OPTICAL COMMUNICATION

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
3	0	0	3	40	60	100	3 hrs

COURSE OBJECTIVE:

To study the conversion of an optical signal into digital format and identify the function of different blocks in optical link. Further the student will be able to analyze the generation and reception of the optical signals. The comparative analysis of techniques to modulate and demodulate the signal will give an insight for the reduced error rates.

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**Introduction**: Need of optical fiber communication system, advantages and disadvantages of optical fiber communication, block diagram of optical fiber communication system, propagation of light in an optical fiber (Ray model). **Electromagnetic Mode Theory**: Electromagnetic waves, TE, TM and TEM modes, phase and group velocity, Goos Haechen shift, modes of optical fiber, step index and graded index fibers.	8
II	**Attenuation in Optical Fibers:** Linear scattering losses - Rayleigh scattering, Mie scattering. Non-linear scattering losses - stimulated Brillion and stimulated Raman scattering. Bending loss, absorption, Dispersion - material dispersion, waveguide dispersion, and intermodal dispersion. **Optical Sources:** Basic concept, LED - principle of LED, LED characteristics. Laser - properties of laser beam, types of lasers, laser characteristics, noise in laser source. Tunable laser diodes - distributed feedback (DFB) laser, distributed Bragg reflector (DBR) laser, vertical cavity surface-emitting laser (VCSEL), comparison of LED and laser.	9

III	**Optical Receivers:** Optical detection principles, physical processes in light detection, performance parameters, photodiode, PIN photodiode, Avalanche photodiode (APD), benefits and drawbacks with the avalanche photodiode, block diagram of optical receiver. **Optical Transmission System:** Concept and components, point to point links, power budgeting, rise time budgeting, multichannel concept, WDM components, system performance parameters.	**9**
IV	**Optical Amplifiers:** Basic applications of optical amplifiers, types of optical amplifier, semiconductor optical amplifiers, Erbium doped fiber amplifier, Raman amplifier. **Fiber Cable Connectors:** Fiber splices - fusion splices, mechanical splices. Fiber connectors - butt jointed connectors, expanded beam connectors.	**8**

Text Books:

1. Gred Keiser, ***Optical Fiber Communication***, McGraw Hill Publication.
2. Casimer Decusatis, ***Handbook of Fiber Optic Data Communication***, Academic Press.
3. Ajay Kashyap, Ashish Sharma,***Optical Fiber Communication Engineering***, PBS Publications.
4. SilvelloBetti, Giancarlo De Marchis and Eugenio Iannone,***Coherent Optical Communications Systems,***Wiley.

Reference Books:

1. Khare,***Fiber optics and Optoelectronics***,Oxford University Press.
2. Selvarajan, Subartkar, T. Srinivas,***Optical Fiber Communication***,Tata McGraw Hill.
3. John Senior,***Optical Fiber Communication***, Prentice Hall of India Publication.
4. Djafar K. Mynbarv, Lowell L. Scheiner,***Fiber Optic Communication***, Pearson Education.

EC-704: VLSI DESIGN

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
3	1	0	4	40	60	100	3 hrs

COURSE OBJECTIVE:

To bring both circuits and system views on design together. It offers a profoundunderstanding of the design of complex analog and digital VLSI circuits.

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**MOSFETS:** Fundamentals of Enhancement Mode MOSFETs, Depletion Mode MOSFETs, Weak & strong Inversion Conditions, Threshold Voltage Concept in MOSFETs, Current-Voltage (IV) Characteristics of a MOSFET, Limitations in IV Model and MOSFET Parasitics. Trends & Projections in VLSI Design & Technology, Flow of VLSI Circuit Design. Scaling in MOS devices.	8
II	**VLSI Design Styles:** NMOS, CMOS Process flow, Noise Margin, Inverter Threshold Voltage, NMOS Inverter design and characteristics, CMOS Inverter Design and Properties, Delay and Power Dissipation. Parallel & Series Equivalent circuits, Static CMOS Circuit Design and Precharge-Evaluate logic, Dynamic CMOS logic circuits.	8

III	**VLSI Physical Design:** Stick Diagrams, Physical Design Rules, Layout Designing, Euler‟s Rule for Physical Design. Reliability issues in CMOS VLSI, Latching. **Memory Design:** ROM Design, SRAM Design.	**9**
IV	**CMOS Amplifier:** Single stage CS amplifier, CG amplifier, CD amplifer **CMOS Differential amplifier:** Single Stage MOS Amplifier, Differential Amplifier and their analysis.	**9**

Text Books:

1. B.G. Streetman & S. Banerjee, "***Solid State Electronic Devices"***, PHI.
2. B. Razavi, "***Design of Analog CMOS Integrated Circuits"***, TMH.

Reference Books:

1. K. Eshraghian & Pucknell, "***Introduction to VLSI"***, PHI.
2. S.M. Kang & Y. Leblebici, "***CMOS Digital Integrated Circuits-Analysis & Design",*** McGraw-Hill.

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EC-711: PROJECT WORK-I.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	**T**	**P/D**	**C**	**Sessional**	**End Semester Exam**	**Total**	
0	0	4	2	50	50	100	3 hrs.

Students are expected to complete a project in groups or alone as deemed fit by the faculty and department. They should work under supervision of Faculty member/s of department, or in collaboration with other departments, or preferably with Industry. The project should demonstrate application of the fundamentals learnt during the course of study and should also be innovative. Any of the following areas may be chosen for pursuing project work.

EC-712: INDUSTRIAL/PRACTICAL TRAINING

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	**T**	**P/D**	**C**	**Sessional**	**End Semester Exam**	**Total**	
0	0	0	2	50	50	100	3 hrs.

Note: Industrial training of 6 weeks duration attended after 6th semester for 6 weeks during summer vacations, and evaluated in 7th semester.

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EC-713: MICROWAVE AND OPTICAL COMMUNICATION LAB

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
0	0	3	2	30	20	50	3 hrs

Note: *The lab practicals may be undertaken by two different faculty members corresponding to their respective subjects for three hours duration each.*

Practicals as per the topics in the syllabus for the course will be conducted in the laboratory. Following is the suggested list of practicals out of which a minimum of 8-10 experiments must be performed by a student during the semester.

LIST OF EXPERIMENTS

1. To study various waveguide components.
2. To study the characteristics of reflex klystron tube to determine its electronics tuning range.
3. To measure standing wave ratio and reflection coefficient in a microwave transmission line.
4. To measure the impedance of unknown load.
5. To study isolation and coupling coefficient of magic-Tee.
6. To measure attenuation and insertion loss of a fixed and variable attenuator.
7. To study working of Doppler radar and measure the velocity of the object moving in the radar range.
8. To design and study wavelength division multiplexer.
9. To study the basic structure and types of optical fiber.
10. To measure the numerical aperture of different cables provided.
11. To design optical transmitter by using LED source and to measure optical power emitted by the LED source.
12. To design and study optical receiver by using photodiode/APD detector.
13. To observe the attenuation and coupling loss in optical fiber.
14. To study the operational characteristics and parameters of photodiode used as photo detector in fiber optic system.
15. To study different types of multiplexing techniques in optical fibers.
16. To study chromatic dispersion in optical communication system.

EC-708: COMPUTER ARCHITECTURE AND ORGANIZATION

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
3	0	0	3	40	60	100	3 hrs

COURSE OBJECTIVE:

This course introduces the principles of computer organization and the basic architectural concepts. The course emphasizes the principles of instruction set design, principle of pipeline processor, memory organization, RISC and CISC processors.

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**Introduction**: Evolution of computers, VLSI era, System design - register level, processor level. CPU organization, data representation, fixed-point numbers, floating point numbers, instruction formats, instruction types, and addressing modes.	8
II	**Data Path Design:** Fixed Point Arithmetic - addition, subtraction, multiplication and division, combinational and sequential ALUs, carry look ahead adder, Robertson algorithm, Booth's algorithm, non-restoring division algorithm, floating point arithmetic, pipeline processing, modified Booth's algorithm.	9
III	**Control Design**: Hardwired control, micro programmed control, multiplier control unit, CPU control unit, pipeline control, instruction pipelines, pipeline performance, nano programming. **Memory Organization:** Random access memories, serial access memories, RAM interfaces, magnetic surface recording, optical memories,	9

	multilevel memories, cache & virtual memory, memory allocation, associative memory.	
IV	**System Organization:** Communication methods, buses, bus control, bus interfacing, bus arbitration, I/O and system control, I/O interface circuits, handshaking, DMA and interrupts, vectored interrupts, pipeline interrupts, IOP organization, multiprocessors, RISC and CISC processors, superscalar and vector processor**.**	**8**

Text Books:

1. John P. Hayes, ***Computer Architecture and Organization***, Tata McGraw-Hill.
2. V.Carl Hamacher, Zvonko G.Varanesic and Safat G.Zaky,***Computer Organization***, Tata McGraw-Hill.

Reference Books:

1. Morris Mano,***Computer System Architecture***, Prentice-Hall of India.
2. P.Pal Chaudhuri,***Computer Organization And Design***, Prentice Hall of India.

EC-709: WIRELESS SENSOR NETWORKS

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
3	0	0	3	40	60	100	3 hrs

COURSE OBJECTIVE:

To study the components of wireless sensor networks. The course provides insight into various details about architecture and application of wireless sensor networks in modern engineering.

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**Characteristics Of WSN:** Characteristic requirements for WSN, Challenges for WSNs ,WSN vs Adhoc Networks , Sensor node architecture, Commercially available sensor nodes , Imote, IRIS, Mica Mote, EYES nodes, BTnodes, TelosB, Sunspot ,Physical layer and transceiver design considerations in WSNs, Energy usage profile, Choice of modulation scheme, Dynamic modulation scaling, Antenna considerations.Applications Of WSN	8
II	**Localization and Time synchronization:** Key issues, Localization approaches, Coarse,grained node localization using minimal information, Fine,grained node localization using detailed information, Network,wide localization, Theoretical analysis of localization techniques, Key issues of time synchronization, Traditional approaches, Fine,grained clock synchronization, Coarse,grained data synchronization.	9
III	**Medium Access Control Protocols:**Fundamentals of MAC protocols , Low duty cycle protocols and wakeup concepts – Contentionbased protocols , Schedule,based protocols , SMAC , BMAC , Traffic, adaptive medium access protocol (TRAMA) , The IEEE 802.15.4 MAC protocol. Operating Systems for Wireless Sensor Networks,TinyOS.	9
IV	**Routing And Data Gathering Protocols:**Routing Challenges and Design Issues in Wireless Sensor Networks, Flooding and gossiping, Data centric Routing, SPIN, Directed Diffusion, Energy aware routing	8

	,Gradient,based routing , Rumor Routing, COUGAR, ACQUIRE – Hierarchical Routing , LEACH, PEGASI, Location Based Routing – GF, GAF, GEAR, GPSR, Real Time routing Protocols, TEEN, APTEEN, SPEED, RAP , Data aggregation , data aggregation operations , Aggregate Queries in Sensor Networks , Aggregation Techniques,TAG, Tiny DB.	

Text Books:

1. Kazem Sohraby, Daniel Minoli and Taieb Znati, " ***Wireless Sensor Networks Technology, Protocols, and Applications",*** John Wiley & Sons, 2007.
2. Holger Karl and Andreas Willig, ***"Protocols and Architectures for Wireless Sensor Networks***", John Wiley & Sons, Ltd, 2005.
3. Bhaskar Krishnamachari : ***Networking Wireless Sensors,*** Cambridge University Press

Reference Books:

1. K. Akkaya and M. Younis, "***A survey of routing protocols in wireless sensor networks***", Elsevier Ad Hoc Network Journal, Vol. 3, no. 3, pp. 325,,349
2. Philip Levis, " TinyOS Programming" 3.Anna Ha´c, "***Wireless Sensor Network Designs***", John Wiley & Sons Ltd.

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EC-710: INTERNET OF THINGS (Internet of Things)

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
3	0	0	3	40	60	100	3 hrs

COURSE OBJECTIVE:

The challenge for the embedded industry is to unlock the value of this growing interconnected web of devices, often referred to as the Internet of Things (INTERNET OF THINGS).The course introduces you to most advance concepts and design methodologies to design INTERNET OF THINGS systems and Develop INTERNET OF THINGS applications using INTERNET OF THINGS optimized programming languages and tools. The course also covers advance INTERNET OF THINGS analytics which helps businesses manage their operations efficiently, track their assets in real time and develop proactive strategies.

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**Machine to Machine towards Internet of Things :** The Vision, Introduction, From Machine to Machine towards Internet of Things- the global context, A use case example, Differing Characteristics. **Embedded Development Boards:** Arduino, Raspberry Pi, Intel Galileo, ESP8266, Beagle Bone black, NodeMCU, mBed, UDOO Neo.	8
II	**A Market Perspective**– Introduction, Some Definitions, Machine to Machine Value Chains, Internet of things Value Chains, An emerging industrial structure for Internet of things, The international driven global value chain and global information monopolies. **Architectural Overview**: Building an architecture, Main design principles and needed capabilities, An Internet of Things architecture outline, standards considerations.	9
III	**Fundamentals:** Devices and gateways, Local and wide area networking, Data management, Business processes in Internet of Things, Everything as a Service(XaaS), Machine To Machine and Internet of Things Analytics, Knowledge Management.	8

	Internet of Things Architecture, State of the Art: Introduction, State of the art, Architecture Reference Model**,** Introduction, Reference Model and architecture, Internet of Things reference Model.	
IV	**Real, World Design Constraints:** Introduction, Technical Design constraints, hardware is popular again, Data representation and visualization, Interaction and remote control. Industrial Automation**,** Service, oriented architecture, based device integration, SOCRADES: realizing the enterprise integrated Web of Things, IMC,AESOP: from the Web of Things to the Cloud of Things, Commercial Building Automation**,** Introduction, Case study: phase one, commercial building automation today, Case study: phase two, commercial building automation in the future.	**9**

Text Books:

1. David Boswarthick, Omar Elloumi Olivier Hersent , "***The Internet of Things: Key Applications and Protocols,*** John Wiley &Sons.
2. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, **"From Machine,to,Machine to the Internet of Things: Introduction to a New Age of Intelligence",** 1st Edition, Academic Press, 2014.

Reference Books:

1. Vijay Madisetti and Arshdeep Bahga, **"Internet of Things (A Hands,on,Approach)",** 1stEdition, VPT, 2014.
2. Francis daCosta, **"Rethinking the Internet of Things: A Scalable Approach to Connecting Everything",** 1st Edition, Apress Publications, 2013.

SEMESTER-VIII

EC- 801: BIOMEDICAL ENGINEERING

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
3	0	0	3	40	60	100	3 hrs

COURSE OBJECTIVE:

Biomedical Engineering education must allow engineers to analyze a problem from both an engineering and biological perspective. The students will be able to understand the foundations of biomedical engineering and how these are applied in the design of biomedical instruments and analysis of biological systems in the health care domain.

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**Fundamentals of Medical Instrumentation:** Role of technology in medicine, landmark developments in biomedical instrumentation, physiological systems of the body, sources of biomedical signals, basic medical instrumentation system, performance requirements in medical instrumentation system, intelligent medical instrumentation system, consumer and portable medical instrument, implantable medical devices, micro electro mechanical systems(MEMS).	**8**
II	**Medical Devices & Bioelectric Potentials:** Wireless connectivity in medical instruments, constraints in design of medical instrumentation system, regulation of medical devices, role of engineer in healthcare facilities, resting and action potentials, propagation of action potential. Physiological Potentials - Electrocardiogram (ECG), Electroencephalogram (EEG), Electromyogram (EMG), Electrogastrogram (EGG), Electrooculograph (EOG) and Electroretinograph (ERG).	**9**

III	**Cardiovascular Measurements:** Cardiovascular system, electrocardiography, ECG recorders, blood pressure measurement, measurement of blood flow and cardiac output, measurement of heart sound, plethysmography, elements of intensive care monitoring, patient monitoring displays, diagnosis, calibration, and reparability of patient-monitoring equipment, surgical monitoring system, arterial diagnostic unit (ADU), catheterization lab, pacemakers, defibrillators.	**9**
IV	**Biotelemetry, Therapeutic And Prosthetic Devices:** Biotelemetry, physiological parameters adaptable to biotelemetry, components of biotelemetry system, implantable units, telemetry for ECG measurements during exercise, telemetry for emergency patient monitoring, audiometers and hearing aids, myoelectric arm, prosthesis configuration unit (PCU), animation control system (ACS), laparoscope, insufflators and irrigator.	**8**

Text Books:

3. Dr. O.N. Pandey, ***Fundamentals of Biomedical Instrumentation***, S.K. Kataria & Sons.
4. R.S. Khandpur,***Handbook of Biomedical Instrumentation***, Tata McGraw Hill.

Reference Books:

3. John G.Webster, ***Medical Instrumentation: Application and Design***, Wiley.
4. Leslie Cromwell, Fred J. Weibell, Erich A. Pfeiffer, ***Biomedical Instrumentation and Measurements***, Pearson.

EC-802: INFORMATION THEORY AND CODING

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
3	0	0	3	40	60	100	3 hrs

COURSE OBJECTIVE:

Information theory is the mathematical theory that deals with the fundamental aspects of communication systems.The course aims at providing students a foundation in information theory, the theory that provides quantitative measures of information and allows us to analyze and characterize the fundamental limits of communication.

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**Information Theory:** Introduction, measure of information, average information content of symbols in long independent sequences, average information content of symbols in long dependent sequences, mark-off statistical model for information source, entropy and information rate of mark-off source. **Source Coding:** Encoding of the source output, Shannon's encoding algorithm,communication channels, discrete communication channels, continuous channels.	9
II	**Fundamental Limits on Performance:** Source coding theorem, Huffman coding, discrete memory less channels, mutual information, channel capacity. **Channel coding theorem:** Channel coding theorem, differential entropy and mutual information for continuous ensembles, channel capacity theorem.	8

III	**Introduction to Error Control Coding:** Introduction, types of errors, examples, types of codes linear block codes: matrix description, error detection and correction, standard arrays and table look up for decoding. **Binary Cycle Codes:** Binary cycle codes, algebraic structures of cyclic codes, encoding using an (n-k) bit shift register, syndrome calculation. BCH codes.	**8**
IV	**RS codes, Golay codes, and Shortened cyclic codes:** RS codes, Golay codes, shortened cyclic codes, burst error correcting codes. burst and random error correcting codes. **Convolution Codes:** Convolution codes, time domain approach, transform domain approach.	**9**

Text Books:

1. Ranjan Bose, ***Information Theory, Coding and Cryptography***, Tata McGraw Hill.
2. N. Abramson,***Information Theory and Coding***, Tata McGraw Hill.

Reference Books:

1. R.B. Ash, ***Information Theory***, Dover Publications.
2. Thomas M. Cover and Joy A. Thomas,***Elements of Information Theory***, Wiley Publications.

EC-803: DIGITAL SYSTEM DESIGN USING HDL

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
3	0	0	3	40	60	100	3 hrs

COURSE OBJECTIVE:

To introduce the basic knowledge of VHDL,data objects, classes &data types. To understand VHDL statements,design combinational circuits and sequential circuits using VHDL. To verify and synthesize RTLmodels and have an understanding of designing, modeling, implementing and verifying several digital circuits.

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**Introduction:** Introduction to computer-aided design tools for digital systems, hardware description languages, introduction to VHDL, data objects, classes and data types,operators, overloading, logical operators, types of delays, entity and architecture declaration, introduction to behavioral, dataflow and structural models.	8
II	**VHDL Statements:** Assignment statements, sequential statements and process, conditional statements, case statements, array and loops, resolution functions, packages &libraries, concurrent statements.	9
III	**Combinational Circuit Design:** VHDL models and simulation of combinational circuits such as multiplexers, encoders, decoders, code converters, comparators, implementation of Boolean functions. **Sequential Circuit Design:** VHDL models and simulation of sequential circuits, shift registers, counters.	9

IV	**Design of Microcomputer:** Basic components of a computer, specifications, architecture of a simple microcomputer system, implementation of a simple microcomputer system usingVHDL. **Design with CPLDs and FPGAs:** Programmable logic devices: ROM, PLAs, GAL, PEEL, CPLDs and FPGA.	**8**

Text Books:

1. Bhasker,***A VHDL Primmer***, Prentice Hall.
2. V.S.Kolte, *A* ***VHDL Design***,Pearson Education.

Reference Books:

1. Charles. H. Roth, ***Digital System Design using VHDL***, PWS(1998)
2. Navabi Z.,***VDHL-Analysis & Modeling of Digital Systems***, McGraw Hill.
3. Brown and Vranesic, ***Fundamentals of Digital Logic with VHDL Design***,TMH.
4. R.P Jain, ***Modern Digital Electronics***,TMH.

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EC-804: DIGITAL IMAGE PROCESSING

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
3	0	0	3	40	60	100	3 hrs

COURSE OBJECTIVE:

To learn and understand the fundamentals of digital image processing, and various image transforms, image enhancement techniques, image restoration techniques and methods, image compression and segmentation used in digital image processing.

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**Fundamentals**: Introduction, origin, areas of image processing, steps in digital image processing, components of image processing system, basic concepts of sampling and quantization, representing digital images,spatial and gray level resolution, aliasing, zooming & shrinking digital images, neighboring of pixels, some basic relationships between pixels.	8
II	**Image Enhancement:** Histogram equalization,histogram specification,local enhancement, image subtraction, image averaging, basics of spatial filtering, smoothing spatial filters, sharpening of filters. **Image Restoration**: A model of the image degradation/ restoration process noise models.	9

III	**Wavelets**: Wavelet functions, wavelet transformations in one and two dimensions,wavelet series expansions,discrete wavelet transform,continuous wavelet transform,series expansion,scaling functions, wavelet functions, haar transform,sub band coding.	**9**
IV	**Image Compression:**Need for data compression, image compression models, error free compression-variable length coding, LZW-coding,bit plane coding,lossless predictive coding, lossy compression-lossy predictive coding,transform coding,wavelet coding. **Image Segmentation:**Point detection,link detection**,**edge detection, ,local processing ,global processing via hough transform ,thresholding foundation ,the role of illumination,basic global thresholding,basic adaptive thresholding, region based segmentation.	**8**

Text Books:

1.Rafael C. Gonzalez, Richard E. Woods,***Digital Image Processing,*** Pearson.
2. Pratt, W. K. ***Digital Image Processing***, John Wiley.

Reference Books:

1. Jain, A.K. Englewood Cliffs***, fundamentals of Digital Image Processing***, Prentice Hall.
2. Rosenfield, A and Kak, A.C., ***Picture Processing***, Academic Press N. Y.

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EC-805: ELECTRONIC SWITCHING SYSTEMS

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
3	0	0	3	40	60	100	3 hrs

COURSE OBJECTIVE:

The primary goal of the course is to give students a foundation for the working of electronic exchanges, PBX, elements of switching systems and traffic engineering. The course presents concepts and fundamentals of cellular mobile telephony and telephone network protocols.

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**Introduction**: Statistical bandwidth sharing, switching, network configurations, elements of switching systems, electronic exchange, PBX. **Telephone Networks**: Subscriber loop, switching hierarchy & routing transmission systems, numbering plan, charging plan, signaling techniques common channel signaling.	8
II	**Electronic Space Division Switch**: Stored program control (SPC)-centralized & distributed SPC, software architecture, and n-stage networks. **Time Division Switching**: Space switching, time switching, time multiplexed space switching & time switching, n-stage combination switching.	9
III	**Traffic Engineering**: Traffic load, grade of service, blocking probability models of switching systems, markov processes, birth-death processes, delay systems, models for packetized sources (voice and video), models for traffic flow in packet networks. **Cellular Mobile Telephony**: Analog switch system for cellular mobile, cellular digital switching centralized & remote controlled small switching	9

	system.	
IV	**Telephone Network Protocols**: Protocols stacks, digital transmission hierarchy, SONET/SDH signaling system,multimedia communication over global telephone network introduction to datagram switches, ATM switches.	**8**

Text Books:

3. Thiagarajan Viswanathan, ***Telecommunication Switching Systems & Networks***, PHI
4. Hui J.Y., ***Switching & Traffic Theory for Integrated Broadband Networks***, Springer Science + Business Media, LLC.

Reference Books:

5. Keshav, S., ***Engineering Approach to Computer Networking***, Addison Wesley.

EC-806: SATELLITE COMMUNICATION

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
3	0	0	3	40	60	100	3 hrs

COURSE OBJECTIVE:

This course presents the fundamentals of satellite communication. The studentswill have the understanding of the basics of orbital mechanics, the types of satellite orbits, ground stations, look angles from earth stations to the satellite, link budget equations, transponders and knowledge about the satellite access schemes.

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**Introduction:** Overview of satellite systems introduction, frequency allocation, INSAT satellite. **Orbits:** Introduction, Kepler laws, orbital element, apogee and perigee heights, orbit perturbations, inclined orbits, calendars, universal time, sidereal time, orbital plane, local mean time and sun, synchronous orbits.	8
II	**Geostationary orbits:** Introduction, Antenna, Look angles, Limits of visibility. **Propagation Impairments & Space Link:** Introduction, Atmospheric loss, ionospheric effects, rain attenuation. Space link - introduction, EIRP, transmission losses, link power budget, systems noise, CNR, uplink, downlink, effects of rain, combined CNR.	9
III	**Space Segment:** Introduction, power supply units, altitude control, station keeping, thermal control, TT&C, transponders, antenna subsystem.	9

	Earth Segment: Introduction, receive only home TV system, outdoor unit, indoor unit, MATV, CATV, Tx – Rx earth station.	
IV	**Interference and Satellite Access:** Introduction, interference between satellite circuits, satellite access, single access, pre-assigned FDMA, SCPC (spade system), TDMA, pre-assigned TDMA, demand assigned TDMA, down link analysis, comparison of uplink power requirements for TDMA & FDMA, on board signal processing satellite switched TDMA.	**8**

Text Books:

1. S.K. Raman,***Fundamentals of Satellite Communication***,Pearson**.**
2. Pratt,***Satellite Communications***, Wiley.

Reference Books:

1. Joseph Pelton,***Satellite Communications***,Springer**.**
2. Bruce R. Elbert***, Introduction to Satellite Communication,*** Artech House.

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EC-807: PROJECT WORK-II

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
0	0	16	8	50	50	100	3 hrs.

Note: Project Work during last semester duration is to be carried out by the student under the joint supervision of faculty advisers from institution as well as from the industry. The work should demonstrate *higher (than previous semesters)* standards of design, analysis and fabrication capability of the student learnt during the course. The students may work in groups, as deemed fit by the faculty/supervisors.

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EC-808: INDUSTRIAL PROJECT

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	**T**	**P/D**	**C**	**Sessional**	**End Semester Exam**	**Total**	
0	0	16	8	50	50	100	3 hrs.

Note: Industrial Project of Four months duration is to be carried out by the student in industry under the joint supervision of faculty advisers from institution as well as from the industry

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