BACHELOR OF TECHNOLOGY (IGDTUW)
(Electronics & Communication Engineering)
(Teaching and Examination Scheme)

THIRD SEMESTER

Sl. No.	Paper Code	Paper Title	L	P	Credits	Course Category
THEORY PAPERS						
1	BAS 201	Numerical Methods	4	-	4	Basic Science
2	BEC 203	Signal & Systems	4	-	4	Departmental Core
3	BEC 205	Network Analysis and Synthesis	4	-	4	Departmental Core
4	BEC 207	Analog Electronics – I	4	-	4	Departmental Core
5	BIT 209	Object Oriented Programming	4	-	4	Engineering Science
PRACTICAL/VIVA VOCE						
1	BAS 251	Numerical Methods Lab	0	2	1	Basic Science
2	BEC 253	Signal & Systems Lab	0	2	1	Departmental Core
3	BEC 255	Network Analysis and Synthesis Lab	0	2	1	Departmental Core
4	BEC 257	Analog Electronics – I Lab	0	2	1	Departmental Core
5	BIT 259	Object Oriented Programming (using C++ & JAVA) Lab	0	2	1	Engineering Science
		TOTAL	**20**	**10**	**25**	

FOURTH SEMESTER

Sl. No.	Paper Code	Paper Title	L	P	Credits	Course Category
THEORY PAPERS						
1	BEC 202	Analog Electronics – II	4	-	4	Departmental Core
2	BEC 204	Digital Circuits & Systems	4	-	4	Departmental Core
3	BEC 206	Communication Systems	4	-	4	Departmental Core
4	**BCS 208	Data Structures Using C++	4	-	4	Departmental Core
5	BEC 210	Transmission Lines and Antennas	4	-	4	Departmental Core
PRACTICAL/VIVA VOCE						
1	BEC 252	Analog Electronics – II Lab	0	2	1	Departmental Core
2	BEC 254	Digital Circuits & Systems Lab.	0	2	1	Departmental Core
3	BEC 256	Communication Systems Lab.	0	2	1	Departmental Core
4	BEC 258	Mini Project	0	2	1	Departmental Core
5	**BCS 260	Data Structure Using C++ Lab	0	2	1	Departmental Core
		TOTAL	**20**	**10**	**25**	

****Proposed to be included w.e.f. January 2016 in place of Probability and Stochastic Processes/Simulation Lab**

BACHELOR OF TECHNOLOGY (IGDTUW)
(Electronics & Communication Engineering)
(Teaching and Examination Scheme)

FIFTH SEMESTER EXAMINATION

Sl. No.	Paper Code	Paper Title	L	P	Credits	Course Category
THEORY PAPERS						
1	BEC 301	Digital Systems Design & VHDL	4	-	4	Departmental Core
2	BEC 303	Advanced Communication Systems	4	-	4	Departmental Core
3	BCS 305	Microprocessors & Microcontrollers	4	-	4	Engineering Science
4	BEC 307	Control Engineering	4	-	4	Departmental Core
5	BEC 309	Electronic Measurement & Instrumentation	4	-	4	Departmental Core
6	BAS 311	Human Values & Professional Ethics	3	-	3	Humanities & Social Sciences
PRACTICAL/VIVA VOCE						
1	BEC 351	Digital Systems Design Lab	0	2	1	Departmental Core
2	BEC 353	Advanced Communication Systems Lab	0	2	1	Departmental Core
3	BCS 355	Microprocessors & Microcontrollers Lab	0	2	1	Engineering Science
4	BEC 357	Control Engineering Lab	0	2	1	Departmental Core
5	BEC 359	Electronic Measurement & Instrumentation Lab	0	2	1	Departmental Core
		TOTAL	**23**	**10**	**28**	

BACHELOR OF TECHNOLOGY (IGDTUW)
(Electronics & Communication Engineering)
(Teaching and Examination Scheme)

SIXTH SEMESTER EXAMINATION

Sl. No.	Paper Code	Paper Title	L	P	Credits	Course Category
THEORY PAPERS						
1	BEC 302	Microwave & Radar Engineering	4	-	4	Departmental Core
2	BEC 304	Information Theory & Coding	4	-	4	Departmental Core
3	BEC 306	VLSI Design	4	-	4	Departmental Core
4	**BIT 308	Data Communication & Networking	4	-	4	Departmental Core
5	BEC 310	Digital Signal Processing and its applications	4	-	4	Departmental Core
6	BAS 312	Engineering Economics	3	-	3	Humanities & Social Sciences
PRACTICAL/VIVA VOCE						
1	BEC 352	Microwave & Radar Engineering Lab	0	2	1	Departmental Core
2	BEC 354	Information Theory & Coding Lab	0	2	1	Departmental Core
3	BEC 356	VLSI Design Lab	0	2	1	Departmental Core
4	**BIT 358	Data Communication & Networking Lab	0	2	1	Departmental Core
5	BEC 360	Digital Signal Processing and its applications Lab	0	2	1	Departmental Core
		TOTAL	**23**	**10**	**28**	

NOTE: 4-6 weeks training will be held after sixth semester. However, Viva-Voce will be conducted in the seventh semester.

**** Proposed to be included w.e.f. January 2016 in place of Fundamentals of Operating Systems/ Fundamentals of Operating Systems Lab**

BACHELOR OF TECHNOLOGY (IGDTUW)
(Electronics & Communication Engineering)
(Teaching and Examination Scheme)

SEVENTH SEMESTER EXAMINATION

Sl. No.	Paper Code	Paper Title	L	P	Credits	Course Category
THEORY PAPERS						
1	BEC 401	Wireless Communication	4	-	4	Departmental Core
2	BEC 405	Optical Communication	4	-	4	Departmental Core
ELECTIVES- I (Choose Any One)						
1.	BCS 403	Mobile Computing	4	-	4	Departmental Elective
2.	BEC 411	VLSI Technology				
3.	BCS 409	Soft Computing				
4.	BMA 407	Non Conventional Energy Resources				
5.	BEC 413	Open Elective "New and Emerging Technologies in Electronics Engineering."				
6.	BIT 421	Cloud Computing & applications				
7.	BEC-423	Advanced Antenna Technology				
ELECTIVES-II (Choose Any One)						
1	BMA 417	Process Improvement Techniques	3	-	3	Humanities & Social Sciences/ Department of IT & MAE
2	BAS 419	Financial Accounting				
3	BIT 415	Cyber Security Awareness				
PRACTICAL/VIVA VOCE						
1	BEC 451	Wireless Communication Lab	0	2	1	Departmental Core
2	BEC 453	Optical Communication Lab	0	2	1	Departmental Core
3	BEC 455	Practical based on Elective-I	0	2	1	Departmental Elective
4	BEC 457	*Minor Project	0	8	4	Departmental Core
5	BEC 459	Practical Training	-	-	2	Departmental Core
6	BAS 461	Disaster Management	0	2	1	Humanities & Social Sciences
		TOTAL	**15**	**16**	**25**	

*The student will submit a synopsis at the beginning of the semester for approval from the departmental committee in a specified format. The student will have to present the progress of the work through seminars and progress reports.

BACHELOR OF TECHNOLOGY (IGDTUW)
(Electronics & Communication Engineering)
(Teaching and Examination Scheme)

EIGHTH SEMESTER EXAMINATION

Sl. No.	Paper Code	Paper Title	L	P	Credits	Course Category
THEORY PAPERS						
1	BCS 402	Embedded Systems Design	4	-	4	Departmental Core
2	BEC 404	Mobile Communication	4	-	4	Departmental Core
ELECTIVES-I (Choose Any One)						
1	BEC 406	Power Electronics	4		4	Departmental Elective
2	BEC 408	Advanced VLSI Design				
3	BEC 410	Digital Image Processing				
4.	BCS 412	Wireless Sensor Networks				
5.	BEC 414	Open Elective "New and Emerging Technologies in Communications & Signal Processing"				
	ELECTIVES_II (Choose any one)					
1	BAS 420	Business Entrepreneurship	3	-	3	Humanities & Social Sciences
2	BAS 422	Organizational Behavior				
	PRACTICAL/VIVA VOCE					
1	BCS 452	Embedded System Design Lab	0	2	1	Departmental Core
2	BEC 454	Mobile Communication Lab	0	2	1	Departmental Core
3	BEC 456	*Major Project	0	12	8	Departmental Core
		TOTAL	**15**	**16**	**25**	
GRAND TOTAL					**212**	

*The student will submit a synopsis at the beginning of the semester for approval from the departmental committee in a specified format. The student will have to present the progress of the work through seminars and progress reports.

NOTE:

1. The total number of the credits of the B.Tech. Programme = 212

2. Each student shall be required to appear for examinations in all courses. However, for the award of the degree a student shall be required to earn the minimum of 204 credits.

Paper Code: BEC 301 **L C**

Paper Title: Digital Systems Design & VHDL **4 4**

INSTRUCTIONS TO PAPER SETTERS: **Maximum Marks: 60**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 20 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 10 marks

Unit I

Introduction to VHDL, modeling concepts, data types and operations, basic modeling constructs, entity, architecture, signal, variable, concurrent statements, sequential statements, Signal drivers, Resolved signals, delay mechanisms, dataflow, behavioral and structural models, Subprograms, configurations, package and testbench, High level description of standard combinational and sequential modules. **[10Hrs]**

Unit II

Introduction to finite state machine, pulse and fundamental mode of operation, realization of state table from verbal description, state diagram & Transition matrix, Mealy and Moore model machine, Reduction of flow tables of completely and incompletely specified sequential machines, concept of secondary state assignment. **[10Hrs]**

Unit III

Realization of circuits of FSM, Decomposition of FSM & composite machine, equivalence between Mealy and Moore model machine, capabilities and limitations of FSM, simplification of incompletely specified machines, analysis of asynchronous FSM, Race and Hazard problems with asynchronous sequential machine. **[10Hrs]**

Unit IV

Introduction to EDA tools, simulation, event driven simulation, RTL synthesis, behavioral synthesis, synthesis for FPGAs, Testing digital systems, Design for testability.

Introduction to programmable logic devices: ROM, PLA, PAL, GAL based circuit, FPGA, CPLD, Architecture and Programming of FPGA/CPLD and hardware implementation. **[10Hrs]**

Text Books

1. Mark Zwolinski, " Digital system design with VHDL", 2nd Edition, 1997.
2. Z. Kohavi, "Switching And Finite Autometa Theory", TMH.
3. Peter J. Ashenden, "The student's guide to VHDL", Morgan Kaufmann publishers, 1998.

Reference Books

1. Charles. H. Roth, "Digital System Design using VHDL", PWS, 1998.
2. Roth, "Fundamental of Logic Design", Cengage learning, 2001.
3. Navabi Z , "VHDL-Analysis & Modelling of Digital Systems", McGraw Hill, 1998.
4. D.J. Comer, "Digital Logic State Machine Design", Oxford University Press, 1999.
5. Bhasker, "A VHDL Primmer", Prentice Hall, 1995.

Paper Code: BEC 303	**L**	**C**
Paper Title: Advanced Communication Systems	**4**	**4**

INSTRUCTIONS TO PAPER SETTERS: **Maximum Marks: 60**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 20 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 10 marks

Unit I

Review of probability and Stochastic Process, Signal space representation, Gram-Schmit organization, Characterization of band limited Channels Pulse code modulation, Channel noise and error probability, Quantization noise and signal-to-noise ratio, robust quantization, Companding, Linear prediction, DPCM, Delta Modulation, Quantization error and SNR calculations, Channel Capacity thermo, Design of MP/ADM, ADPCM. **[10Hrs]**

Unit II

Binary data formats, Inter symbol interference, Nyquist criterion for distortionless baseband binary transmission, Correlative coding – duo – binary and modified duo- binary signaling and precoder, Eye pattern, Introduction to Equalization techniques, zero forcing, mean squared error linear equalizer, Decision feedback equalizer, Optimum design of transmit and receive filters, Conceptual Receiver Design using MF & Maximum likelihood Algorithm. **[10Hrs]**

Unit III

State space/Constellation Diagram based design of Coherent and non coherent Digital Receivers with BPSK, DPSK, DEPSK, BFSK, QPSK, QAM, MSK, GMSK transmitter and receiver implementation, Probability of error calculations, Bandwidth Efficiency, Carrier synchronization methods by calculating probability of miss-of probability of false detection. **[10Hrs]**

Unit IV

Pseudo-Noise Sequences and Spread Spectrum, Model of a Spread Spectrum Communications Systems, Direct Sequence Spread spectrum Signals, frequency – hopping and time – hopping spread spectrum systems, correlation functions, spreading sequences maximal-length sequences, gold codes, Walsh orthogonal codes, properties and generation of sequence like Rake Receivers, Multi-user Detection, Frequency Hopped Spread Spectrum Signals, Other types of spread spectrum signals, Spread Spectrum in multipath channels, Multichannel Digital Communications in AWGN, Multicarrier Communications, OFDM- Introduction, Transmitter and Receiver Structure, Performance Analysis. **[10Hrs]**

Text Book

1. John G. Proakis, Masoud Salehi, “Digital Communications”, Mc Graw Hil, 5th Edition, 2010.
2. Bernard Sklar, “Digital Communications, Fundamentals and Applications”, Pearson, 2nd Edition, 2010.
3. Simon Haykins, “Digital Communication”, John Wiley and Sons, 2010.
4. Tri. T. Ha, “Theory and Design of Digital Communication”, Cambridge University Press, 2011.

Reference Books

1. Glover, “Digital Communication”, Pearson, 2007.
2. John G. Proakis, Masoud Salehi, “Fundamental of Communication System”, Pearson, 1st Edition, 2007.

Paper Code: BCS 305 **L C**
Paper Title: Microprocessor & Microcontroller **4 4**

INSTRUCTIONS TO PAPER SETTERS: MAXIMUM MARKS: 60

1 Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 20 marks.

2 Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only question from each unit. Each question should be 10 marks.

Unit-I

Introduction to Microprocessor and Microcontroller:

Introduction to microprocessors, classification, basic architecture and its applications. Introduction to microcontrollers, classification, basic architecture and its applications. Difference between microprocessors and microcontrollers. **Programming:** Various programming languages to program Microprocessor and Microcontroller, High-level language, assembly language, machine language. **Tools:** Integrated development environment for application development, assemblers, compilers. **[10 Hrs]**

Unit-II

8085 microprocessor:

Introduction to 8085 microprocessor: Architecture, pin diagram, instruction set, and classification of instruction set, instruction and data format, timing diagram of instructions, basic concept of programming, addressing modes of 8085 microprocessors, 8086 architecture, BIU and EU, registers, pin diagram and Instruction set of 8086. **[10 Hrs]**

Unit-III

8051 Microcontroller:

8051 architecture, pin diagram, instruction set and classification of instruction set, instruction and data format, timing diagram of instructions, basic concept of programming, addressing modes. I/O Ports, SFRs, Timer, Counters, UART, SPI, I2C, External interrupt handling, Watch dog timer. **[10 Hrs]**

Unit-IV

8051 Interfacing and Applications: Interfacing Keyboard and Display Devices: LED, 7-segment LED display, LCD, ADC, DAC, DC motor, Stepper motor. **Advanced Microcontrollers:** Case study of AVR, ATMEGA, PIC and ARM microcontrollers.

[10 Hrs]

TEXT BOOKS:

1. Ramesh S. Goankar, "Microprocessor Architecture, Programming and Applications with 8085", Prentice Hall, 5th Edition, 2002.
2. Douglas V. Hall, "Microprocessors and interfacing: programming and hardware", McGraw-Hill, 2nd Edition, 1990.
3. Muhammad Ali Mazidi, "The 8051 Microcontroller and Embedded Systems, Using assembly and C", Pearson, Second Edition, 2008.

REFERENCE BOOKS:

1. Raj Kamal, "Embedded Systems", TMH, 2006.
2. K Ayala, "The 8051 Microcontroller", Thomson Delmar Learning, 3RD Edition, 2007.
3. H.W Huang, "PIC Microcontroller", Delmar CENGAGE Learning, 2007.

Paper Code: BEC-307 **L C**
Paper Title: Control Engineering **4 4**

INSTRUCTIONS TO PAPER SETTERS: **Maximum Marks: 60**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 20 marks.
2. Apart from Q. No. 1 rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 10 marks.

Unit I

Definitions of Control Systems, Closed Loop and Open Loop Control, Examples of Control Systems, Laplace Transformation and Solution of Differential Equations, Concept of Mathematical model, Linear and Non-Linear Systems, Transfer Function with Simple Examples, Transfer function of physical systems (Mechanical Translational Systems), Armature controlled and field controlled DC servomotors, AC servomotors and deriving their transfer functions, Block Diagram representation, Block Diagram Reduction Technique. **[10 Hrs]**

Unit II

Signal Flow graph, Mason gain formula, Basic Control Actions, Proportional, integral and Derivative controllers, effect of feedback on control system, Transient and steady state response of first order system, Second order system, Transient, Static error coefficients, position, velocity and acceleration error coefficients. **[10 Hrs]**

Unit III

Stability of Control System, Routh's Stability criterion, relative stability analysis, Root Locus Techniques, Bode Plot, Determination of Transfer function from Bode Plot, Polar Plots, Nyquist Criterion Stability. **[10 Hrs]**

Unit IV

Definitions of state, state variables, state space, representation of systems, Solution of time invariant, homogeneous state equation, state transition matrix and its properties, Z transform and solution of difference equation, Transducers, Stepper Motor, Rotating Amplifiers and Magnetic Amplifiers. **[10 Hrs]**

Text Books:

1. I. J. Nagrath, M. Gopal, "Control System Engineering", New Age International, 2000.
2. Ogata, "Modern Control Engineering", 4th Edition, 2010.

Reference Books:

1. Kuo, "Automatic Control Systems", PHI, 7th Edition, 2013.
2. N. K. Jain, "Automatic Control System Engineering", Dhanpat Rai, 2nd Edition, 2011.

Paper Code: BEC 309 **L C**
Paper Title: Electronic Measurement & Instrumentation **4 4**

INSTRUCTIONS TO PAPER SETTERS: **Maximum Marks: 60**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 20 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 10 marks.

Unit I

Role of Measurement Systems, General Principles of Measurements, Standards of Measurement, Units and Dimensions, Errors in Measurement, Classification & its statistical Analysis, Moving Coil Instruments, Moving Iron Instruments, Dynamo Meter Instruments, Induction Instruments, Extension of Ranges, Shunts and Multipliers. **[10 Hrs]**

Unit II

Measurement of Current, Voltage and Power, Measurement of Resistance, Wheatstone Bridge, Kelvin Double Bridge, Megger, Measurement of Inductance, Maxwell's Bridge, Hay's bridge, Anderson's Bridge, Desauty's Bridge, Measurement of Capacitance, Schering Bridge, Measurement of Frequency, Wien's Bridge. **[10 Hrs]**

Unit III

Multirange Ammeters, RF Ammeter, Multirange Voltmeter, Transistor Voltmeter (TVM), Differential Voltmeter, AC voltmeters using Half Wave and Full Wave Rectifiers, True RMS Voltmeter, Ohmmeter, Series and Shunt, LCR bridge, Q- meter.

AF Sine and Square Wave Generator, Basic Wave Analyzer, Heterodyne Wave Analyzer, Harmonic Distortion Analyzer, Spectrum Analyzer. **[10 Hrs]**

Unit IV

Digital Measurements, Digital Voltmeter, Voltage to frequency converter, Digital Multimeter, A/D and D/A converters, Ramp Type, Dual Slope Integration Type, Successive approximation Type $3\frac{1}{2}$ Digit.

Transducers, Classification and Selection, Displacement Transducers, Linear Variable Differential Transformer, Photoelectric Transducers, Piezoelectric Transducers, Thermo-Electric Transducers. **[10 Hrs]**

Text books:

1. Golding E.W, "Electrical Measurements & Measuring Instruments", Wheeler Pub., 1999.
2. Cooper W.D, "Modern Electronics Instrumentation", Prentice Hall of India, 1996.
3. A. K. Sawhney, "Electrical and Electronic Measurements and Instrumentation", Dhanpatrai and Sons, New Delhi, 12th Edition, 2001.

Reference books:

1. Oliver &Cage, "Electronic Measurements & Instrumentation", McGraw Hill, 1979.
2. J B Gupta, "Electronics & Electrical Measurements and Instrumentation", Katson Publication, 1999.

Paper Code: BAS 311 **L P C**
Paper Title: Human Values and Professional Ethics **3 0 3**

INSTRUCTIONS TO PAPER SETTERS: MAXIMUM MARKS: 60

1 Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 20 marks.
2 Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 10 marks

UNIT – I
Human Values
Morals, Values and Ethics, Integrity, Work Ethic, Respect for Others, Living Peacefully, Caring, Sharing, Honesty, Valuing Time, Co-operation, Commitment, Empathy, Self-Confidence, Character, Spirituality. Indian values (on the conceptual framework of Vedas): Purusharth, Niskama karma, Religion and Human Values, Towards a World Religion, Ethical Living and Harmony in Life. **[8 Hrs]**

UNIT – II
Ethics and Engineering Profession
Profession and Professionalism, Ethical Theories: Kohlberg's Theory, Gilligan's Theory, Feminist Consequentialism, Moral Dilemmas, Types of Enquiry, Uses of Ethical Theories, Engineering Profession, Engineering Professionals- Training, Skill Set, Life Skills, Engineering Ethics: Making Senses and Issues, Ethical Obligations of Engineers, Ethical Codes for Engineers. **[7 Hrs]**

UNIT - III
Engineering as a Social Experimentation, Safety Responsibility and Rights:
Engineering as experimentation, Engineers as responsible Experimenters, Concept of Safety and Risk, Engineer's Responsibility for Safety, Risk – Benefit Analysis, Case Studies: The challenger case study, The Three Mile Island, Fukushima Nuclear Disaster, Bhopal Gas Tragedy. Disaster Management, Professional Rights, Employee Rights, Intellectual Property Rights (IPRs), Human Rights and Human Responsibilities. Major Ethical Issues. **[8 Hrs]**

UNIT – IV
Ethics and Global Issues
Ethics in Global Scenario, Multinational corporations, Environmental ethics, computer ethics, Business Ethics. Corporate Social responsibility, Weapons Development, Research Ethics.
[7 Hrs]

Text Books

1. Govindarajan M., Natarajan S., Senthil Kumar V. S., "Engineering Ethics", Prentice Hall, New Delhi, 2004.
2. Subramaniam R., "Professional Ethics", Oxford University Press, New Delhi, 2013.
3. Mike Martin and Roland Schinzinger, "Ethics in engineering", McGraw-Hill, New York 1996.
4. RR Gaur, R Sangal, GP Bagaria, "A Foundation Course in Human values and Professional Ethics", Excel Books Pvt. Ltd, New Delhi 2009.
5. A.N.Tripathi, "Human Values", New Age International Publishers, New Delhi, 2nd Edition, 2004.

Reference Books

1. B.P. Banerjee, "Foundation of Ethics and Management", Excel Books, 2005.
2. Fleddermann, Charles D., "Engineering Ethics", Pearson Education. 2004.
3. Harris, Charles E., Protchard, Michael S. And Rabins, Michael, J., Wadsworth, "Engineering Ethics- Concepts and Cases", Thompson Learning, 2000

4. Boatright, John R., “Ethics and the Conduct of Business”, Pearson Education, New Delhi, 2003.
5. Swami Ranganathananda, “Universal Message of the Bhagavad Gita: An exposition of the Gita in the light of modern thought and modern needs”, Vol. I – III, Advaita Ashrama (Publication Department), Kolkata. 2000.
6. Peter Singer, “Practical Ethics”, Oxford University Press, 1993.

				L	**P**	**C**
Paper Code	:	BEC 351	-	2	1	
Paper Title	:	Digital Systems Design & VHDL Lab Experiments based on Theory				
Paper Code	:	BEC 353	-	2	1	
Paper Title	:	Advanced Communication System Lab Experiments based on Theory				
Paper Code	:	BEC 357	-	2	1	
Paper Title	:	Control Engineering Lab Experiments based on Theory				
Paper Code	:	BEC 359	-	2	1	
Paper Title	:	Electronic Measurement & Instumentation Lab Experiments based on Theory				

(Note: Minimum 8 experiments must be performed in each Lab)

Paper Code: BEC 302 **L C**
Paper Title: Microwave & Radar Engineering **4 4**

INSTRUCTIONS TO PAPER SETTERS:
Maximum Marks: 60
1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 20 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question be of 10 marks.

Unit I

History, Introduction and Applications of Microwaves, Review of Electromagnetic waves and Maxwell's Equations, Rectangular and Cylinder waveguides, Construction and wave propagation, Solution of wave equation, Modes in waveguide, Excitation of Modes, field patterns, propagation properties, Power transmission and Power losses, Components & Elements, S-parameters, Cavity resonators (Cylindrical and rectangular), Waveguide tees, Magic Tree, Hybrid tees, Hybrid couplers, waveguide corners, Joint, bends and twists, Irise and screws, short circuit, Attenuator, Directional couplers, Circulators, Isolators, Faraday's rotation, Phase shifter. **[10 Hrs]**

Unit II

Klystron Amplifier, Reflex Klystron, Magnetron (cylindrical), Overview of TWT, CFA, M/W Solid state Device & MICS, M/W Bipolar Transistor, M/W FET, Varactor and Step Recovery Diodes, pin Diode, Schottky Diode, Parametric Amplifiers, Tunnel Diode, Gunn Diode, Read Diode, Impatt, Trapatt. **[10 Hrs]**

Unit III

Introduction to MIC, Stripline and Microstrips, Introduction to fabrication of MICs, Introduction to Microwave Detectors, Mixers, Switches, Microwave Measurements, Measurements of frequency, power, attenuation, phase shift, VSWR, impedance, Introduction to Microwave filters. **[10 Hrs]**

Unit IV

Introduction to Electronic Warfare, Radar block diagram, Radar range equation, Radar Antennas, Max and Min Range, Overview of pulsed radar, Pulse Radar Characteristics, CW Doppler Radar, MTI radar and Tracking radar.

[10 Hrs]

Text Books:

1. S.Y. Liao, "Microwave Devices" Pearson, 3rd Edition, 1990.
2. Rizzi, "Microwave Engg. Passive Circuits", PHI, 2001.

Reference Books:

1. Rao, "Microwave and Radar Engg.", Pearson, 1st Edition, 2014.
2. Kulkarni, "Microwave & Radar Engg." Umesh Publications, 2nd Edition. 2010.

Paper Code: BEC 304 **L P C**

Paper Title: Information Theory and Coding **4 0 4**

INSTRUCTIONS TO PAPER SETTERS: **Maximum Marks: 60**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 20 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 10 marks.

UNIT I

Information Theory: Information- Entropy, Information rate, classification of codes, Kraft McMillan inequality, Source coding theorem, Shannon-Fano coding, Huffman coding, Extended Huffman coding - Joint and conditional entropies, Mutualinformation- Discrete memory less channels - BSC, BEC - Channel capacity, Shannon limit. **[10H]**

UNIT II

Source coding: Adaptive Huffman Coding, Arithmetic Coding, LZW algorithm Channel, Linear Predictive coding, Introduction to Audio coding, Perceptual coding, Masking Techniques, Introduction to Speech Coding, Channel Vocoder. **[10H]**

UNIT III

Error control coding: block codes: Definitions and Principles: Hamming weight,Hamming distance, Minimum distance decoding - Single parity codes, Hamming codes, Repetition codes - Linear block codes, Cyclic codes - Syndrome calculation, Encoder and decoder - CRC, Convolution codes - code tree, trellis, state diagram - Encoding - Decoding: Sequential search and Viterbi algorithm. **[10H]**

UNIT IV

Error control coding: convolutional codes: Principle of Turbo coding Video Compression - Principles I,B,P frames, Motion Estimation, Motion Compensation.

Random process: Definition and examples, first order, second order, strictly stationary, wide-sense stationary, Ergodic process and Markov process - Binomial, Poisson and Normal processes, sine wave processes, random telegraph process. **[10H]**

Text Books:

1. R Bose, "InformationTheory, Coding and Cryptography," TMH, 2007.
2. Fred Halsall, "Multimedia Communications: Applications,Networks, Protocols and Standards," Pearson Education Asia, 2002.
3. K Sayood, "Introduction to Data Compression," Elsevier, 3^{rd} Edition, 2006.

References Books:

1. S Gravano, "Introduction to Error Control Codes," Oxford University Press2007.
2. Amitabha Bhattacharya, "Digital Communication," TMH, 2006.
3. Cover and Thomas, "Elements of Information Theory," Wiley Series in Telecommunication and Signal Processing, 2^{nd} Edition, 2006.

Paper Code: BEC 306 **L C**
Paper Title: VLSI Design **4 4**

INSTRUCTIONS TO PAPER SETTERS: **Maximum Marks: 60**
1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 20 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 10 marks

Unit I

Evolution of VLSI technology trends in VLSI, MOS transistor theory, MOS structure, enhancement & depletion transistor, threshold voltage, MOS device design equations, MOSFET scaling and small geometry effects, MOSFET capacitances, transconductance, figure of merit. Fabrication of MOSFET, CMOS fabrication process steps, isolation, latchup, twin well process, triple well process, Color codes for representations of MOS transistor. **[10 Hrs]**

Unit II

NMOS inverter, resistive and active load, pull up/pull down ratio, CMOS inverter design, DC characteristics, static & dynamic power dissipation, switching characteristics, rise time, fall time delays, noise margin. Basic CMOS logic gate design, Transistor sizing, combinational MOS logic circuits, pass transistor and transmission gate designs, tristate buffers, cascaded inverters and super buffers, cascaded inverters & pass transistors & its analysis. **[10 Hrs]**

Unit III

Sequential MOS logic circuits: SR latch, clocked latch and flip flop circuits, CMOS D latch and edge triggered flip flop, dynamic logic circuits; basic principle, non ideal effects, domino CMOS logic, high performance dynamic CMOS circuits, clocking issues, clock distribution. Semiconductor memories, DRAM, SRAM, EPROM, Flash memory. **[10 Hrs]**

Unit IV

CMOS chip design, design strategies, design flow, design Hierarchy, concept of regularity, modularity & locality, Chip design using PLDs, ASIC, CMOS chip testing, need for testing. Layout,micron and lambda based design rules, MOSIS, Low power design concepts using CMOS and SOI Technology. **[10 Hrs]**

Text Books

1. S. M. Kang, Y. Lebiebici, "CMOS digital integrated circuits analysis & design" Tata McGraw Hill 3rd Edition, 2007.
2. N. Weste and D. Harris, "CMOS VLSI Design: A Circuits and Systems Perspective - 4th Edition", Pearson Education, India,2009.

Reference Books

1. Pucknell Douglas A., Eshraghian Kamran, "Basic VLSI Design", PHI Learning Pvt. Limited, 2013.
2. Ken Martin, "Digital Integrated Circuit Design", Oxford University Press, 2005.
3. Yannis Tsividis and Colin Mcandrew, "The MOS Transistor", Oxford University Press, 2013.
4. J. M. Rabaey, "Digital Integrated Circuits" PHI Learning Pvt Limited, India, 2012.
5. J. P. Uyemura, "Introduction to VLSI Circuits and Systems", John Wiley & Sons, Inc., New York, NY, 2010.

Paper Code: BIT 308 **L P C**

Paper Title: Data Communication & Networking **4 0 4**

INSTRUCTIONS TO PAPER SETTERS: **Maximum Marks: 60**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 20 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 10 marks.

UNIT I

Introduction, goals and applications of Networks, Layering Concept, OSI Reference Model vs TCP/IP Protocol Suite, Networks Topology.

Physical Layer: Signals, Digital Transmission, Analog to Digital & Digital to Digital conversion, Analog Transmission, Digital to Analog & Analog to Analog conversion, Multiplexing (FDM & TDM), Media (Guided and Unguided), Switching (Packet based & Circuit based), Hub & Repeater, Sampling theorem (Nyquist-Shannon Theorem).

Network Traffic Capturing: Wireshark (Windows) and tcpdump (Linux) **[10H]**

UNIT II

Data Link Layer: Addressing, Error Detection & Correction, General concepts, Checksum & CRC, Medium Access (Aloha, CSMA, CSMA/CD & CA), Protocols (Ethernet, ARP & RARP), Switch (Learning & Filtering Mechanism), Wireless Access (Bluetooth, WiFi).

Network Layer: IP Addressing & Subnets, basic Routing (or Forwarding) Mechanism, IPv4 frame format and functions, Routing protocols (RIP, OSPF & BGP) and Distance Vector & Link State algorithms.

Linux Network Commands: arp, route, ifconfig, netstat, traceroute, ping. **[10H]**

UNIT III

Transport Layer: Port. Addresses, Protocols (Simple, Stop n Wait, Go Back N & Selective licspeat), UDP services & applications, TCP header format, connection setup & termination, state transition diagram, now control, error control, congestion control & timers. **[10H]**

UNIT IV

Application Layer: Web & HTTP, FTP, Email, Telnet, SSH, DNS.

Advanced Protocols: SNMP, RTP, SIP, BitTorrent, Wireshark (Case Studies). **[10H]**

Text Books:

1. Forouzan, "Data Communication and Networking," TMH, 5^{th} Edition, 2013.
2. A. S. Tanenbaum, "Computer Networks," PHI, 4^{th} Edition, 2002.
3. W. Stallings, "Data and Communication," Macmillan Press, 2013.
4. Comer, "Computer Networks and Internet," PHI, 2008.
5. Comer, "Networking with TCP/IP," PHI, 2008.

References Books:

1. W. Stallings, "Data and Computer Communication," McMillan, 2010.
2. J. Martin, "Computer Networks and Distributed Data Processing," PHI, 2008.
3. W. Stallings, "Local Networks," McMillan, 2013.
4. S. Keshav, "An Engineering Approach to Computer Networking, Pearson," 2001.

Paper Code: BEC 310 **L C**

Paper Title: Digital Signal Processing & its Applications **4 4**

INSTRUCTIONS TO PAPER SETTERS: **Maximum Marks: 60**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 20 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 10 marks

Unit I

DFT and its properties, Relation between DTFT, Z transform with DFT, Overlap-add and save methods, FFT computations using Decimation in time (DIT) and Decimation in frequency (DIF) algorithms for radix 2 and composite number. **[10 Hrs]**

Unit II

Review of design of analogue Butterworth and Chebyshev Filters, Frequency transformation in analogue domain, Design of IIR digital filters using impulse invariance technique, Design of digital filters using bilinear transform, pre warping, Realization using direct, cascade, parallel, state space and lattice form. **[10 Hrs]**

Unit III

Symmetric and Antisymmetric FIR filters, Linear phase FIR filters, Design using Hamming, Hanning Rectangular, Blackmann and Bartlett Windows, Frequency sampling method, Realization using direct, cascade, and lattice form. **[10 Hrs]**

Unit IV

Fixed point and floating point number representations, Comparison, Truncation and Rounding errors, Quantization noise, derivation for quantization noise power, coefficient quantization error, Product quantization error, Overflow error, limit cycle oscillations due to product roundoff and overflow errors, Introduction to Multirate signal processing, Decimation-Interpolation, rational sampling rate conversion, Applications of Multirate signal processing. **[10 Hrs]**

Text Books

1. John G Proakis, Dimtris G Manolakis, “Digital Signal Processing Principles, Algorithms and Application”, PHI, 3rd Edition, 2000.
2. Alan V Oppenheim, Ronald W Schafer, John R Back, “Discrete Time Signal Processing”, PHI, 2nd Edition, 2000.

Reference Books

1. Johny R.Johnson, “Introduction to Digital Signal Processing”, Prentice Hall, 1984.
2. S.K.Mitra, "Digital Signal Processing - A Computer based approach", Tata McGraw-Hill, 1998, New Delhi.

Paper Code: BAS 312 **L T C**
Paper Title: Engineering Economics **3 0 3**

INSTRUCTIONS TO PAPER SETTERS **MAXIMUM MARKS: 60**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 20 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 10 marks.

UNIT – I

Introduction: Meaning Nature and Significance of Economics, Economic Process, Micro Economics and Macro Economics, Economy: Definition, Types, Central Problems, Economic Development Indicators, Sustainable Development, a Glimpse of Indian Economy. Meaning of Science, Engineering and Technology and their relation with Economics, Role of Engineers in Economic Development.

[7 Hrs]

UNIT – II

Demand Analysis: Meaning and Law of Demand, Demand Elasticity- Types and Uses, Demand Forecasting: Meaning and Uses, Supply Analysis, Production Function, Cost and Revenue Concepts, Producer's Equilibrium, Law of variable Proportion, Law of Returns to Scale.
Market: Meaning of Market, Basic Features of Different markets: Perfect Competition, Monopoly, Oligopoly, Monopolistic Competition, and Price Determination under different Market Conditions.

[8 Hrs]

UNIT – III

Money and Banking: Money, Meaning, Types and Functions. Bank: Definition, Types and Functions, Credit Creation, Role of Central Bank- RBI, Introduction to Indian Financial system. Inflation: Meaning, Types, Causes and Measures to Control Inflation. Monetary Policy, Fiscal Policy, Business Cycle, National Income Concepts: NNP_{FC} and GDP_{MP}.

[7 Hrs]

UNIT – IV

Financial Economics: Concepts of Time Value of Money, Interest, Cost, Annuity. Project Evaluation Methods: NPV, IRR, PI. Introduction to Financial Management: Role and Functions, Financial Accounting, Uses of Important Financial Statements: Statement of Profit and Loss, Balance Sheet, Cash flow Statement. Decision making Models (No numerical Applications): Linear Programming, Input Output Model, Econometric Models. Introduction to Process Improvement Techniques- TQM, Six Sigma, Benchmarking. **[8 Hrs]**

TEXT BOOKS

1. Riggs, Bedworth and Randhawa, "Engineering Economics", McGraw Hill Education India. 1997.
2. K.K. Dewett, "Modern Economic Theory" S.Chand, New Delhi. 2005.
3. Seema Singh, "Economics for Engineering Students", I.K. International Publishing House, New Delhi. 2009.
4. D.N. Kakkar, "Managerial Economics for Engineering", New Age International Publication. 2014.
5. D.N. Dwivedi, "Managerial Economics" Vikas Publishing House. New Delhi. 2008.

REFERENCE BOOKS

1. C. T. Horngreen, "Cost Accounting ", Pearson Education India. 2012.
2. R. R. Paul, "Money banking and International Trade", Kalyani Publisher, New-Delhi. 2008.
3. S.C. Sharma and T.R. Banga, "Industrial Organization and Engineering Economics". Khanna Pub. 1999.
4. S.N. Maheswari, "Financial and Management Accounting" Sultan Chand & Sons. 2010.

5. Mishra & Puri, “Indian Economy”, Himalaya Publishing House, New Delhi. 2000.

			L	P	C
Paper Code	:	BEC 352	-	2	1
Paper Title	:	Microwave & Radar Engineering Lab Experiments based on Theory			
Paper Code	:	BEC 354	-	2	1
Paper Title	:	Information Theory & Coding Lab Experiments based on Theory			
Paper Code	:	BEC 356	-	2	1
Paper Title	:	VLSI Design Lab Experiments based on Theory			
Paper Code	:	BEC 358	-	2	1
Paper Title	:	Fundamentals of Operating System Lab Experiments based on Theory			
Paper Code	:	BEC 360	-	2	1
Paper Title	:	Digital Signal Processing &its Applications Lab Experiments based on Theory			

(Note: Minimum 8 experiments must be performed in each Lab)