SAMRAT ASHOK TECHNOLOGICAL INSTITUTE
(Engineering College), VIDISHA M.P.
(An Autonomous Institute Affiliated to RGPV Bhopal)
Program: Electronics and Communication Engineering
Department : Electronics Engineering

Subject Catagory	DC	Subject Code	EC-501	Subject Name	Digital Signal Processing

Maximum Marks Allotted								Contact Hours			Total Credits
Theory				Practical			Total Marks				
End Sem	Mid-Sem	Assignment	Quiz	End Sem	Lab-Work	Quiz		L	T	P	
60	20	10	10	30	20	10	150	3	-	2	4

Prerequisites:

Signals &Systems

Course Objective:

The objective of this course is to introduce the students with the concept of ProcessingDiscrete Time Signals and System Realization.

Course Outcomes:

CO 1: Understand and demonstrate fundamentals of filtering and their concepts, filter specifications. (BL1, BL2, BL3)

CO 2: Analyse different FIR and IIR systems in time and frequency domain. (BL3, BL4)

CO 3: Design different FIR and IIR systems as per given specificationes in frequencydomain. (BL3, BL6)

CO 4: Evaluate performance of different FIR and IIR systems based on design method and coefficient quantization. (BL3, BL5)

UNITs	Descriptions	Hrs.	CO's
I	Relating the Z-transform and DTFT, DTFT and DFT, DFS and DFT, System analysis using the DTFT, Spectral leakage, Spectral spacing and zero padding. Filtering method based on DFT, FFT algorithms: Decimation in Time (DIT) and Decimation infrequency (DIF), comparison of DIT and DIF algorithms, Computation advantage of FFT algorithms	09	All CO's
II	Filter concepts: Gain, Phase delay, Group delay, minimum phase factor, Graphical view of filters frequency response, pole zero pattern of linear phase filters. Types of linear phase sequences, averaging filters, First and second order IIR filters,pole-zero placement and filter design.	09	All CO's
III	Filter specifications, the impulse invariance transformation, bilinear and matched Z-Transform. Design of high pass, band pass and band stop digital IIR filters. Spectral transformation of IIR filters, finite word length effects, effect of coefficient quantization.	09	All CO's
IV	Ideal filters, truncation and windowing, FIR filters and linear phase, Types of linear phase sequences for FIR filter design, window based, frequency sampling FIR differentiators and Hilbert transformers.	09	All CO's

V	Basic structures for FIR and IIR systems, Lattice structures, Number representation fixed and floating point, effects of coefficient quantization, effects of round off noise in digital filters, zero input limit cycle.		09	All CO's
		Guest Lectures (if any)	03	
		Total Hours	48	
		Suggestive list of experiments:		
1.	2.	3. Signal generation and manipulation.-CO2 4. Verification of sampling theorem (use interpolation function).-CO2 5. Linear and circular convolution of two given sequences. Commutative. distributive and associative property of convolution.-CO2 6. Auto and cross correlation of two sequences and verification of their properties-CO2 7. Solving a given difference equation.-CO2 8. Computation of N point DFT of a given sequence and to plot magnitude and phase spectrum (using DFT equation and verify it by built-in routine).-CO2 9. Verification of DFT properties (like Linearity and Parseval's theorem, etc.)-CO2 10. DFT computation of square pulse and Sinc function etc.-CO2 11. Design and implementation of Low pass and High pass FIR filter to meet the desired specifications (using different window techniques) and test the filter with 1. an audio file. Plot the spectrum of audio signal before and after filtering.-CO4 12. Design and implementation of a digital IIR filter (Low pass and High pass) to meet given specification and test with an audio file. Plot the spectrum of audio signal before and after filtering. CO4 13. Obtain the Linear convolution of two sequences.-CO3 14. Compute Circular convolution of two sequences.-CO3 15. Compute the N-point DFT of a given sequence.-CO2 16. Determine the Impulse response of first order and second order system.-CO3 17. (a) 1Evalate performance of FIR using different window functions. -CO4 (b) 1Evalate performance of FIR based on coefficient quantization. -CO4 (c) 1Evalate performance of IIR. using different window functions.-CO4 Batch of students have to develop a mini project in form of circuit design, hardware fabrication, simulation program or conduct a case study relevant to the subject curriculum		
Modes of Evaluation and Rubric				
Final Exam, Mid Sem Exam, Quiz, Assignments, Practical, External/Internal Viva, Attendance				
Recommendation by Board of studies on				
Approval by Academic council on				
Compiled and designed by		Mrs. Bharti Mehra		

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Program: Electronics and Communication Engineering
Department : Electronics Engineering

Subject Category	DC	Subject Code	EC-502	Subject Name	Microprocessor & Microcontroller

Maximum Marks Allotted								Contact Hours			Total Credits
Theory				Practical			Total Marks				
End Sem	Mid-Sem	Assignment	Quiz	End Sem	Lab-Work	Quiz		L	T	P	
60	20	10	10	30	20	10	150	3	-	2	4

Prerequisites:

Basic Electronics, Digital Circuit System

Course Objective:

1. To make students familiar with the basic blocks of 8 bit & 16 bit Microprocessors and 8-bit Microcontroller device in general.
2. To provide comprehensive knowledge of the architecture, features and interfacing with peripheral of Intel 8085/8086 microprocessor and Intel 8051 Microcontroller.
3. To use assembly and high-level languages to program the microprocessor and microcontroller and interface it to various applications.

Course Outcomes:

On successful completion of this course student should be able to:

CO1: Acquire and demonstrate fundamental knowledge of microprocessors andmicrocontroller interfacing and programming (BL1,BL2)

CO2:Understand the capabilities of microprocessor/microcontroller with the help of instruction set (BL3, BL4)

CO3: Develop instruction codes and write assembly codes /Embedded C language programming for problem solving (BL3, BL6)

CO4: Identify problems and Design real-world solutions with interfacing ofhardware (BL3, BL5))

UNITs	Descriptions	Hrs.	CO's
I	Introduction of computer organization & Microprocessor- Architecture and function of general computer system, CISC, RISC, CPU, Memory, Input/output device, Address, Data and Control Buses. 8085/8086 Microprocessor: Architecture, Pin Diagram, Instruction set and various functional units. Memory Interfacing, I/O Mapped I/O and Memory Mapped I/O.	10	1,2,3
II	Introduction to 8-bit microcontroller: Overview of 8051 family, Architecture of8051 microcontroller. Compare processor & controller, Data type and AssemblerDirective, PSW, register banks and stack, Program counter and ROM space, memory, GPR and SFR.	09	1,2
III	8051 Programming: Addressing modes, Instruction sets, Arithmetic/LogicalInstruction, Loop/Jump/Call, Bit manipulation instruction	09	1,2,3

	etc. Pin description of 8051,Power-on Reset circuits, Input & output Port Programming.		
IV	On-chip peripheral device: Concepts of Timer/Counter and its Programming, an overview of serial communication and serial port programming,concepts of interrupt, type of interrupts, priority of interrupts, Introduction toembedded C. Elementary programming of 8051 in assembly and C.	09	1,2,3,4
V	8051 Real-world interfacing: LED and switch interface, Motor, 7-segment,LCD and keyboard interfaces. ADC, DAC, and sensor/actuator interfacing andElementary programming.	08	1,2,3,4
Total Hours		45	

Suggestive list of experiments:

1. Study of 8051 simulation software. CO-2
2. Write an assembly language program for an 8051 Microcontroller to interface an LED. CO3
3. Write an assembly language program for an 8051 Microcontroller to interface a switch. CO3
4. Write an assembly language program for an 8051 Microcontroller to interface a 7-segment. CO3
5. Write an assembly language program for an 8051 Microcontroller to interface an LCD. CO3
6. Write an assembly language program for an 8051 Microcontroller to interface a Motor. CO3
7. Write an assembly language program for an 8051 Microcontroller to interface an ADC. CO3
8. Write an assembly language program for an 8051 Microcontroller to interface a DAC. CO3
9. Write an assembly language program for an 8051 Microcontroller to interface a KEYPAD. CO3
10. Write an assembly language program for an 8051 Microcontroller to interface an MEMORY. CO3
11. Write an assembly language program for an 8051 Microcontroller to on chip Timer. CO3
12. Write an assembly language program for an 8051 Microcontroller to interface serial communication port. CO3

Batch of students have to develop a mini project in form of circuit design, hardware fabrication, simulation program or conduct a case study relevant to the subject curriculum

Text Book-

- Ramesh S Goankar, Microprocessor Architecture, Programming & Applications with the 8085, Penram International Publishing (India) Pvt. Ltd., Fourth Edition, 2002.
- M Mazidi and J. G. Mazidi , 8051 Microcontroller and Embedded Systems using assembly and C, Pearson Education.

Reference Books-

- Microprocessors and Microcontrollers: Architecture, Programming & Interfacing using 8085, 8086, and 8051 by Soumitra Kumar Mandal, Tata Mcgraw Hill Education
- A K Ray & K M Bhurchandi, Advanced Microprocessor and Peripheral, Tata McGraw-Hill Publishing Company Limited.
- Douglas V. Hall, Microprocessors and interfacing programming and hardware Gregg Division, McGraw-Hill, 1986
- A NagoorKani, Microprocessor and Microcontroller, CBS publishers
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Modes of Evaluation and Rubric	
Final Exam, Mid Sem Exam, Quiz, Assignments, Practical, External/Internal Viva, Attendance	
Recommendation by Board of studies on	
Approval by Academic council on	
Compiled and designed by	Prof. Bharti Mehra

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Program: Electronics and Communication Engineering
Department : Electronics Engineering

Subject Catagory	DC	Subject Code	EC-503	Subject Name	Microwave Theory and Techniques

Maximum Marks Allotted								Contact Hours			Total Credits
Theory				Practical			Total Marks				
End Sem	Mid-Sem	Assignment	Quiz	End Sem	Lab-Work	Quiz		L	T	P	
60	20	10	10	30	20	10	150	3	-	2	4

Prerequisites:

- Electromagnetic Field Theory
- Antenna Theory

Course Objective:

This course will introduce students to the concepts of Microwave theory and design. He will be able to understand the working of Microwave systems. Generation, detection and measurement of microwaves.

Course Outcomes:

On successful completion of this course student should be able to:

CO1: Understand the basic concept and principle of microwave transmission system, microwave network and components, microwave solid-state and vacuum tubes devices and measurement devices. (BL1,BL2)

CO2: Analyze different microwave transmission line and network, characteristics of microwave devices using S-Parameters. To establish the measurement bench set-up for measuring various microwave parameters.—(BL3, BL4)

CO3: Design different waveguides, resonators, port networks, couplers, isolators.—(BL3, BL6)

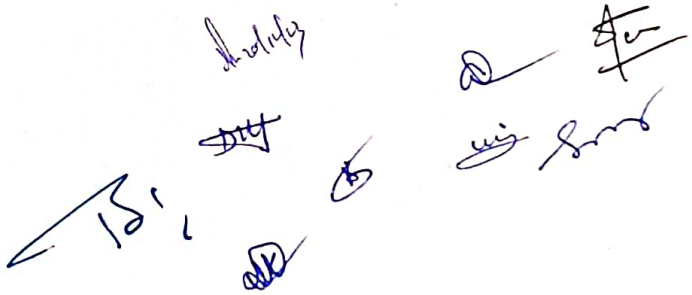
CO4: Evaluatevarious microwave parameters by using different measurements and testing techniques. (BL3, BL5)

UNITs	Descriptions	Hrs.	CO's
I	Microwave Transmission System: Introduction, Microwave spectrum, Uniform guide structures, rectangular wave guides, Circular Wave guides, Solution in terms of various modes, Properties of propagating and evanescent modes, Dominant modes, Normalized model voltages and currents, Power flow and energy storage in modes frequency range of operation for single mode working, effect of higher order modes, Strip line and micro strip lines general properties, Comparison of coaxial, Micro strip and rectangular wave guides in terms of band width, power handling capacity, economical consideration etc.	10	1,2,3,4
II	Microwave Networks and Component: Transmission line ports of microwave network, Scattering matrix, Properties of scattering matrix of reciprocal, Non reciprocal, Examples of two, three and four port networks, wave guide components like attenuator, Phase shifters and couplers, Flanges, Bends, Irises, Posts, Loads, Principle of operation and properties of E-plane, H-plane Tee junctions of wave guides, Hybrid T, Multi-hole directional coupler, Directional couplers, Microwave resonators- rectangular. Excitation of wave guide and resonators by couplers.Principles of operation of non reciprocal devices, properties of	8	1,2, 3,4

	ferrites and Isolators		
III	Microwave Solid State Devices and Application: PIN diodes, Properties and applications, Microwave detector diodes, detection characteristics, Varactor diodes, parametric amplifier fundamentals, Manley-Rowe power relation, Frequency converters and harmonic generators using varactor diodes, Transferred electron devices, Gunn effect, Various modes of operation of Gunn oscillator, IMPATT, TRAPATT and BARITT diodes.	8	1,2,4
IV	Microwave Vacuum Tube Devices: Interaction of electron beam with electromagnetic field, power transfer condition. Principles of working of two cavity and Reflex Klystrons, arrival time curve and oscillation conditions in reflex klystrons, mode frequency characteristics. Effect of repellervoltage variation on power and frequency of output. Principle of working of magnetrons. Electro dynamics in planar and cylindrical magnetrons, Cutoff magnetic field, Resonant cavities in magnetron, Π mode operation Mode separation techniques, Rising sun cavity and strapping. Principle of working of TWT amplifier. Slow wave structures, Approximate gain relationship in forward wave TWT.	8	1,2,4
V	Microwave Measurements: Square law detection, Broadband and tuned detectors. Wave-guide probes, Probe and detector mounts, Slotted line arrangement and VSWR meter, Measurement of wave-guide impedance at load port by slotted line, Microwave bench components and source modulation. Measurement of scattering matrix parameters. High, Medium and low-level power measurement techniques, Characteristics of bolometers, bolometer mounts, Power measurement bridges, Microwave frequency measurement techniques, calibrated resonators (transmission and absorption type). Network Analyzer and its use in measurements.	8	1,2
Guest Lectures (if any)			
Total Hours		45	
Suggested List of Experiments			
1. To determine the frequency and wavelength in rectangular waveguide working on TE10 mode.-CO2 2. To determine the SWR and reflection coefficient.CO2 3. Study of VI characteristics of Gunn diode.CO1 4. Study of following characteristics of Gunn diode: (a) Output Power and frequency as a function of bias voltage.CO1 (b) Square wave modulation through Pin diodeCO1 5. Study of attenuator.CO1 6. Study of phase shifter.CO1 7. Measurement of dielectric constant (liquid and solid): (a) Low loss solid dielectrics.-CO2 (b) Liquid dielectrics or solutions.CO2 8. Study of voice Communication by using microwave test bench.-CO1 9. Study of PC to PC communication by using microwave test bench.CO1 10. Study of resonant cavity.CO1 Batch of students have to develop a mini project in form of circuit design, hardware fabrication, simulation program or conduct a case study relevant to the subject curriculum		
Text Book- • Liao: Microwave Devices and Circuits, Pearson Education. • Kulkarni, "Microwave Engineering", DhanpatRai New Delhi			

• Rao: Microwave Engineering, PHI Learning
Reference Books- • Collins: Foundations of Microwave Engineering, Wiley India. • Srivastava and Gupta: Microwave Devices and Circuits, PHI Learning. • Reich: Microwave Principles, East West Press. • Pozar: Microwave Engineering, Wiley India • Roy and Mitra: Microwave Semiconductor Devices, PHI learning.
Modes of Evaluation and Rubric
Final Exam, Mid Sem Exam, Quiz, Assignment, Attendance

Recommendation by Board of studies on	
Approval by Academic council on	
Compiled and designed by	Dr. Sweety Jain



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Program: Electronics and Communication Engineering
Department : Electronics Engineering

Subject Catagory	DE-I	Subject Code	EC-504(A)	Subject Name	Wireless Communication

Maximum Marks Allotted								Contact Hours			Total Credits
Theory				Practical			Total Marks				
End Sem	Mid-Sem	Assignment	Quiz	End Sem	Lab-Work	Quiz		L	T	P	
60	20	10	10	-	-	-	100	3	1	-	4

Prerequisites:

- Probability Theory,
- Digital Communication.

Course Objective:

The student should be made to: Know the characteristic of wireless channel. Learn the various cellular architectures. Understand the concepts behind various digital signalling schemes for fading channels. Be familiar the various multipath mitigation techniques. Understand the various multiple antenna systems.

Course Outcomes:

At the end of the course, the student should be able to:

CO1: Acquire knowledge of wireless communication techniques, systems, processes and able to demonstrate it. -(BL1, BL2, BL3)

CO2: Analyse different parameters of wireless transmission. (BL3, BL4)

CO3: Design and implement various signalling schemes for fading channels, compare multipath mitigation techniques and analyse their performance Design and implement systems with transmit/receive diversity and multiuser system -(BL3, BL6)

CO4: Evaluate the performance of different wireless channels using different technique. (BL3, BL5)

UNITs	Descriptions	Hrs.	CO's
I	Probability and Stochastic Processes: Basics of Probability RandomVariable, Probability Distributions, and Probability Density Functions of Random Variables, Statistical Averages of Random Variables, Some Useful Probability Distributions, Central Limit Theorem. Stochastic Processes: Statistical Averages, PowerDensity Spectrum, Discrete-Time Stochastic Signals and System, stationary Processes.	20	1
II	WIRELESSCHANNELS: Large scale pathloss Path loss models: Free Space and Two-Ray models -Link Budget design – Small scale fading- Parameters of mobile multipath channels – Time dispersion parameters Coherence bandwidth – Doppler spread & Coherence time, fading due to Multipath time delay spread – flat fading – frequency selective fading – Fading due to Doppler spread – fast fading – slow fading.	9	1,2

III	DIGITAL SIGNALING FOR FADING CHANNELS: Structure of a wireless communication link, Principles of Offset-QPSK, p/4-DQPSK, Minimum Shift Keying, Gaussian Minimum Shift Keying ,Error performance in fading channels,	10	3,4
IV	MULTIPATH MITIGATION TECHNIQUE : Equalization–Adaptive equalization, Linear and Non-Linear equalization, zero forcing and LMS Algorithms. Diversity–Micro and Macro diversity, Diversity combining techniques, Error probability in fading channels with diversity reception, Rake receiver.	8	2,4
V	MULTIUSER AND MULTI CARRIER SYSTEM :- Conventional Multiple Access FDMA TDMA CDMA, Multi carrier system, OFDM principle – Cyclic prefix, Windowing, PAPR.OFDMA	8	3
Guest Lectures (if any)			
Total Hours		45	

Text Book-

- Rappaport T. S., "Wireless communications", Second Edition, Pearson Education, 2010.

Reference Books-

- Andreas. F. Molisch, "Wireless Communications", John Wiley – India, 2006.
- David Tse and Pramod Viswanath, "Fundamentals of Wireless Communication", Cambridge University Press, 2005.
- UpenaDalal, "Wireless Communication", Oxford University Press, 2009.
- Van Nee, R. and Ramji Prasad, "OFDM for Wireless Multimedia Communications", Artech House, 2000.
- John G. Proakis, "Digital Communications", Edition 4th ed., McGraw-Hill, 2000.

Modes of Evaluation and Rubric

Final Exam, Mid Sem Exam, Quiz, Assignments, Practical, External/Internal Viva, Attendance

Recommendation by Board of studies on	
Approval by Academic council on	
Compiled and designed by	Dr. Neelesh Mehra

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Program: Electronics and Communication Engineering
Department : Electronics Engineering

Subject Catagory	DE-I	Subject Code	EC-504(C)	Subject Name	Power Electronics

Maximum Marks Allotted								Contact Hours			Total Credits
Theory				Practical			Total Marks				
End Sem	Mid-Sem	Assignment	Quiz	End Sem	Lab-Work	Quiz		L	T	P	
60	20	10	10	30	20	10	150	3	1	-	4

Prerequisites:

- Basic Electrical Engg.
- Analog Electronics
- Network analysis.

Course Objective:

Study of this subject provides the following course objectives:

1. To impart knowledge about various power semiconductor devices.
2. Prepare the students to analyze and design different power converter circuits.
3. Prepare the students to apply power semiconductor devices in different Industrial and Home appliances..

Course Outcomes:

This course primarily contributes to EC program outcomes that develop students abilities to:

CO1- Acquire fundamental concepts of semiconductor switches.
CO2-Understand operation and applications of different power electronics converters
CO3-Identify basic requirements for power electronics based design application.
CO4-Comprehend operation of inverters, choppers, controllers and cycloconverters.
CO5-Apply power converters to develop commercial and industrial applications.

UNITs	Descriptions	Hrs.	CO's
I	**Power, Semiconductor Devices:** Classification of Power semiconductor devices, characteristics, construction, application and theory of operation of power diode, power transistor, thyristors. Device specifications and ratings, working of Diac, Triac, IGBT, GTO and other power semiconductor devices. Turn-on / turn-off methods and their circuits.		
II	**Rectifiers:** Review of uncontrolled rectification an its limitations, controlled rectifiers, half wave, Full wave configurations, multiphase rectification system, use of flywheel	8	1,2,3

20.12.23

	diode in controlled rectifier configurations for different types of load.		
III	**Inverters and Choppers**: Classification of inverters, Transistor inverters, Thyristor inverters, Voltage and Current Communicated inverters, PWM inverters, Principle of Chopper, Chopper classification and their working, Regulators.		
IV	**A. C. Voltage Controllers and Cycloconverters**: Classification and operation of a.c. voltage controllers and cycloconverters, their circuit analysis for different types of load.		
V	**Industrial Applications**: Solid-state switching circuits, Relays, Electronic Timer, Battery charger, Sawtooth generator, Applications in Industrial process control, Motor drive applications, Electronic regulators, etc., Induction heating, Dielectric Heating, Resistance welding and welding cycle.		
Guest Lectures (if any)			
Total Hours			

Text Book-

- Power electronics, converters, applications & design - Need Mohan et.al., Wiley
- Power Electronics - P.C.Sen, TMH
- Power Electronics: Devices, Circuits & MATLAB Simulations, Alok Jain, Penram Int. Publication.

Reference Books-

- Power Electronics Circuits, devices & applications - M.H. Rashid, PHI.
- Semiconductor Power Electronics- CM Pauddar

Modes of Evaluation and Rubric

Quiz/Assignment, Mid Semester Exam, End Semester Exam, Attendance

Recommendation by Board of studies on	
Approval by Academic council on	
Compiled and designed by	Dr. Alok Jain

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Electronics Engineering Department

Semester/Year		III/II	Program		B.Tech.
Subject Category	**DLC**	Subject Code:	**EC506**	Subject Name:	**Simulation Lab - II**

Maximum Marks Allotted								Contact Hours			Total Credits
Theory				Practical			Total Marks				
End Sem	Mid-Sem	Assignment	Quiz	End Sem	Lab-Work	Quiz		L	T	P	
-	-	-	-	30	10	10	50	0	0	4	2

Prerequisites:

Basic Mathematics, Digital Logic Design, Network Analysis, Signal and System, Digital Signal Processing

Course Objective:

The objective of this course is to introduce the fundamental concepts of virtual instrumentation and to develop basic VI programs. The objective of this course is twofold. First one is to familiarize the students with LabVIEW environment, its uses and implementation methodologies. Second one is to educate students on implementation of in area of signal, image, and automation and control industry using LabVIEW software.

Course Outcomes:

Upon completion of this course, the student will be able to-

CO1: Understand of Virtual Instrumentation.
CO2: Understand Basic Concept of graphical programming.
CO3: Understand difference between Virtual Instruments and Traditional Instruments.
CO4: Analyze and design different type of VI programs and data acquisition.
CO5: Demonstrate the use of LabVIEW for signal processing, image processing etc.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1		2	1	1			1			1
CO2	3	2	2		1							
CO3	3	3	1	1	1							
CO4	3	2	3	3	1	1						
CO5	3	2	3	3	1	1			1		1	1

Contents:

Module	Descriptions	Hrs.	CO's
I	Introduction to Virtual Instrumentation and LabVIEW, Evolution or history of Virtual Instrumentation, Drawbacks of Recent Approaches, Conventional Virtual Instrumentation versus Traditional Instruments, Advantages and Applications of LabVIEW	04	1
II	Programming Techniques: Block diagram and Architecture of Virtual Instruments, VIS, Arrays, Clusters, and Graphs.	04	2
III	Sub VIS, Loops & Charts, Case & Sequence structures, Feedback Nodes, Formula Nodes,	06	3,4
IV	Local and Global Variable, String, State Machines, File Input/output and String Handling.	04	4,5
V	Advanced analysis tools such as Fourier transforms, Power spectrum, Correlation methods, Windowing and filtering and their applications in signal and image processing	06	5
Guest Lectures (if any)			
Total Hours		24	

Suggestive **list of experiments:**

1. Basic Arithmetic Operations and Mathematical Expression.
2. Boolean Indicators, Logic Gates and Boolean Operations (OR, AND and NOT)
3. Conversions of Radian to Degree and Degree to Radian.
4. Binary to Decimal Conversion and vice versa.
5. Array and Various Array Operations.
6. Sum of 'N' Numbers using Loops (For and While)
7. Factorial of a Give Number Using While Loop
8. Case Structure
9. Sorting Even Numbers using While Loop in an Array
10. Design and implements Half adder and Full adder
11. Bundle and Unbundle Cluster
12. Formula Node and Application using Formula Node
13. Design Seven Segment display
14. Design Water Tank Problem
15. Simulation of Signals and Spectral Analysis
16. Sampling, Aliasing, Quantization and Reconstruction

Batch of students have to develop a mini project in form of circuit design, hardware fabrication, simulation program or conduct a case study relevant to the subject curriculum

Text Books-

1. S. Gupta and J. John, *Virtual Instrumentation using LabVIEW*, Tata McGraw-Hill Publishing Company Limited, 2010.
2. Jovitha Jerome, *Virtual Instrumentation Using Labview*, Prentice Hall of India, 2010

Reference Books-

1. Bruce Mihura, *LabVIEW for Data Acquisition*, Prentice Hall of India, 2013

2. R Bitter, T Mohiuddin, M Nawrocki, *LabVIEW: Advanced Programming Techniques*, CRC Press, 2007
Modes of Evaluation and Rubric
Laboratory work is prescribed; the practical marks are 50, out of which 30 marks will be awarded for viva voce, 10 marks for lab work and 10 marks for Quiz.

Recommendation by Board of studies on	Date:
Approval by Academic council on	Date:
Compiled and designed by	Name 1.**Dr. D.K.Shakya**
Checked and approved by	Name 1. Dr Ashutosh Datar