DR. RAM MANOHAR LOHIA AVADH UNIVERSITY, AYODHYA

Structure of Syllabus for the

Program: M.Sc., Subject: ELECTRONICS

Structure of Syllabus Developed by			
Name of BoS Convener/ BoS Member	**Designation**	**Department**	**College/ University**
Prof. C.K. Mishra	Dean	Faculty of Science	Dr. R.M.L. Avadh University, Ayodhya
Prof. Anupam Srivastava	Head & Convenor	Physics & Electronics	Dr. R.M.L. Avadh University, Ayodhya
Prof. R.K.Tiwari	Professor	Physics & Electronics	Dr. R.M.L. Avadh University, Ayodhya
Prof. S.N.Shukla	Professor	Physics & Electronics	Dr. R.M.L. Avadh University, Ayodhya
Prof. K.K.Verma	Professor	Physics & Electronics	Dr. R.M.L. Avadh University, Ayodhya
Prof. G.R.Mishra	Professor	Physics & Electronics	Dr. R.M.L. Avadh University, Ayodhya
Dr. Geetika Srivastava	Associate Professor	Physics & Electronics	Dr. R.M.L. Avadh University, Ayodhya
Dr. Anil Kumar	Assistant Professor	Physics & Electronics	Dr. R.M.L. Avadh University, Ayodhya
Prof. D.K.Dwivedi	Professor	Physics & Material Science	MMM University of Technology, Gorakhpur
Prof. R.K.Singh	Professor	Physics	BHU, Varansi
Prof. Umesh Yadav	Professor	Physics	DDU Gorakhpur University Gorakhpur
Prof. Manish Mishra	Professor	Department of Electronics	DDU Gorakhpur University Gorakhpur
Dr.U.N.Tripathi	Professor	Department of Computer Science	DDU Gorakhpur University Gorakhpur

Course Code		**Course Title**	**Credits**	**T/P**	**Evaluation**	
					CIE	**ETE**
A	B	C	D	E	F	G
SEMESTER I (YEAR I)						
B140701T	CORE	Mathematical Techniques in Electronics	4	T	25	75
B140702T	CORE	Semiconductor Devices and Circuits	4	T	25	75
B140703T	CORE	Digital System Design	4	T	25	75
B140704T	CORE	C Programming	4	T	25	75
B140705T	FIRST ELECTIVE (Select any one)	Electronic Measurement & Instrumentation	4	T	25	75
B140706T		Physics of Electronic Materials	4	T	25	75
B140707P	SECOND ELECTIVE (Select any one)	Electronics Laboratory Course -I (A)	5	P	50	50
B140708P		Electronics Laboratory Course -I (B)	5	P	50	50

SEMESTER II (YEAR I)						
B140801T	CORE	Network Analysis and Synthesis	5	T	25	75
B140802T	CORE	Microprocessor and Microcontrollers	5	T	25	75
B140803T	CORE	Electromagnetic Theory and Antenna	5	T	25	75
B140804T	THIRD ELECTIVE (Select any one)	Programming with MATLAB	5	T	25	75
B140805T		Introduction to IoT	5	T	25	75
B140806P	FOURTH ELECTIVE (Select any one)	Electronics Laboratory Course -II (A)	5	P	50	50
B140807P		Electronics Laboratory Course -II (B)	5	P	50	50
SEMESTER III (YEAR II)						
B140901T	CORE	Communication Theory and Systems	4	T	25	75
B140902T	CORE	Control System	4	T	25	75
B140903T	CORE	Power Electronics	4	T	25	75
B140904T	CORE	Analog Integrated Circuits	4	T	25	75
B140905T	FIFTH ELECTIVE (Select any one)	Artificial Intelligence and Machine Learning	4	T	25	75
B140906T		VHDL Programming	4	T	25	75
B140907P	SIXTH ELECTIVE (Select any one)	Electronics Laboratory Course -III (A)	5	P	50	50
B140908P		Electronics Laboratory Course -III (B)	5	P	50	50
SEMESTER IV (YEAR II)						
B141001T	CORE	VLSI Design and Technology	5	T	25	75
B141002T	CORE	Digital Signal Processing	5	T	25	75
B141003T	SEVENTH ELECTIVE (Select any one)	Optoelectronics and Optical Communication	5	T	25	75
B141004T		Radar Satellite Communication and Remote Sensing	5	T	25	75
B141005P	RESEARCH PROJECT/ DISSERTATION	Major Research Project/ Dissertation	10	P	50	50

Program Outcomes (POs):
• The program has been designed in such a way so that the students acquire strong theoretical and practical knowledge in various domains of Electronics.

- The programme includes details of Electronic Devices, Digital System Design, Linear Integrated Circuits, Electromagnetic theory and Antenna, Communication System, Digital Signal Processing, VLSI Design, Machine Learning, IoT etc to provide in depth knowledge of Electronics so that they can contribute in the society in their respective research area and become entrepreneur.
- The practical courses have been designed to equip the students with the laboratory skills in Electronics. Students will able to hardware design, application of simulation tools to and conduct experiments and also able to system design and verification through simulation tools.
- The program will offer students with the knowledge and skill base that would enable them to undertake advanced studies in field of Electronics and related areas or in multidisciplinary areas that involves Electronics.
- The students will get exposure of wide range of careers that includes, VLSI design, Signal Processing, Communication Engineering, Embedded System Design, IoT and Machine Learning.
- The students will gain domain knowledge for successful career in academia, industry and research.
- Moreover, students will learn values for lifelong learning to meet the ever-evolving professional demands by developing ethical, inter personal and team skills.

Semester wise Paper Titles with Details					
Year	**Semester**	**Paper**	**Paper Title**	**Prerequisite for Paper**	**Elective for Major Subjects**
Master in Physics (Electronics)					
First	SEM-I	Theory Paper – I (Core)	Mathematical Techniques in Electronics	B.Sc. (Physics, Chemistry, Mathematics, Electronics, Computer Science, Computer Application, Statistics)	M.Sc (Physics/ Computer Science/Mathematics/ Statistics)
		Theory Paper –II (Core)	Semiconductor Devices and Circuits	B.Sc. (Physics, Chemistry, Mathematics, Electronics, Computer Science, Computer Application, Statistics)	M. Sc (Physics/ Mathematics/Computer Science)
		Theory Paper – III (Core)	Digital System Design	B.Sc. (Physics, Chemistry, Mathematics, Electronics, Computer Science, Computer Application, Statistics)	M.Sc (Physics/ Mathematics/Computer Science)
		Theory Paper – IV (Core)	C Programming	B.Sc. (Physics, Chemistry, Mathematics, Electronics, Computer Science, Computer Application, Statistics)	M.Sc (Physics/ Mathematics/Computer Science))
		Theory	Electronic Measurement and Instrumentation	B.Sc. (Physics, Chemistry, Mathematics, Electronics, Computer Science, Computer Application, Statistics)	M.Sc (Physics/ Mathematics/Computer Science)

		Paper – V First Elective (Subject Elective- Select any one)	Physics of Electronic Materials	B.Sc. (Physics, Chemistry, Mathematics, Electronics, Computer Science, Computer Application, Statistics)	M.Sc (Physics/ Mathematics/Computer Science)
		Practical Second Elective (Subject Elective- Select any one)	Electronics Laboratory Course -I (A)	B.Sc. (Physics, Chemistry, Mathematics, Electronics, Computer Science, Computer Application, Statistics)	
			Electronics Laboratory Course -I (A))	B.Sc. (Physics, Chemistry, Mathematics, Electronics, Computer Science, Computer Application, Statistics)	
	SEM-II	Theory Paper – I (Core)	Network Analysis and Synthesis	B.Sc. (Physics, Chemistry, Mathematics, Electronics, Computer Science, Computer Application, Statistics)	M.Sc (Physics/Computer Science)
		Theory Paper –II (Core)	Microprocessor and Microcontrollers	B.Sc. (Physics, Chemistry, Mathematics, Electronics, Computer Science, Computer Application, Statistics)	M.Sc (Physics/ Mathematics/Computer Science)
		Theory Paper – III (Core)	Electromagnetic Theory and Antenna	B.Sc. (Physics, Chemistry, Mathematics, Electronics, Computer Science, Computer Application, Statistics)	M.Sc (Physics/ Mathematics/ Computer Science)
		Third Elective (Generic Elective- Select any one)	Programming with MATLAB	B.Sc. (Physics, Chemistry, Mathematics, Electronics, Computer Science, Computer Application, Statistics)	M.Sc (Physics/ Mathematics/ Computer Science)
			Introduction to IoT	B.Sc. (Physics, Chemistry, Mathematics, Electronics, Computer Science, Computer Application, Statistics)	M.Sc (Physics/ Mathematics/ Computer Science)
		Forth Elective	Electronics Laboratory Course -II (A)	B.Sc. (Physics, Chemistry, Mathematics, Electronics, Computer Science,	

		(Select any one)		Computer Application, Statistics)	
			Electronics Laboratory Course -II (A)	B.Sc. (Physics, Chemistry, Mathematics, Electronics, Computer Science, Computer Application, Statistics)	
Second	SEM-III	Theory Paper - I	Communication Theory and Systems	B.Sc. (Physics, Chemistry, Mathematics, Electronics, Computer Science, Computer Application, Statistics)	M.Sc (Physics/Computer Science)
		Theory Paper - II	Control System	B.Sc. (Physics, Chemistry, Mathematics, Electronics, Computer Science, Computer Application, Statistics)	M.Sc (Physics/Computer Science)
		Theory Paper – III	Power Electronics	B.Sc. (Physics, Chemistry, Mathematics, Electronics, Computer Science, Computer Application, Statistics)	M.Sc (Physics)
		Theory Paper - IV	Analog Integrated Circuits	B.Sc. (Physics, Chemistry, Mathematics, Electronics, Computer Science, Computer Application, Statistics)	M.Sc (Physics/ Mathematics/ Computer Science)
		Fifth Elective (Subject Elective- Select any one)	Artificial Intelligence and Machine Learning	B.Sc. (Physics, Chemistry, Mathematics, Electronics, Computer Science, Computer Application, Statistics)	M.Sc (Physics/ Mathematics/Computer Science)
			VHDL Programming	B.Sc. (Physics, Chemistry, Mathematics, Electronics, Computer Science, Computer Application, Statistics)	M.Sc (Physics/ Mathematics/Computer Science)
		Sixth Elective (Subject Elective- Select any one)	Electronics Laboratory Course -III (A)	B.Sc. (Physics, Chemistry, Mathematics, Electronics, Computer Science, Computer Application, Statistics)	
			Electronics Laboratory Course -III (A)	B.Sc. (Physics, Chemistry, Mathematics, Electronics, Computer Science, Computer Application, Statistics)	
	SEM-IV	Theory Paper - I	VLSI Design and Technology	B.Sc. (Physics, Chemistry, Mathematics, Electronics,	

				Computer Science, Computer Application, Statistics)	
		Theory Paper - II	Digital Signal Processing	B.Sc. (Physics, Chemistry, Mathematics, Electronics, Computer Science, Computer Application, Statistics)	M.Sc (Physics/ Mathematics/Computer Science)
		Seventh Elective (Subject Elective- Select any one)	Optoelectronics and Optical Communication	B.Sc. (Physics, Chemistry, Mathematics, Electronics, Computer Science, Computer Application, Statistics)	M.Sc (Physics/Computer Science)
			Radar Satellite Communication and Remote Sensing	B.Sc. (Physics, Chemistry, Mathematics, Electronics, Computer Science, Computer Application, Statistics)	M.Sc (Physics/ Computer Science)
		Research Project/Dissertation	Major Research Project/Dissertation		

Program/Class: Master of Science in Electronics	Year: First	Semester: I
Subject: Electronics		
Course Code: B140701T	**Course Title: Mathematical Techniques in Electronics**	

Course Objectives:

The objective of the course is to provide knowledge of Signals to students of M.Sc Electronics. This Course includes good insight of types of signals, various operations performed on them through the use of Fourier series, Fourier transform Laplace Transform and their application in Signal and Circuit analysis. This is also foundation course for advanced courses in Electronics

Course outcomes:

At the end of this course, students will be

1. Able to describe the signals mathematically and understand how to perform mathematical operations on signals.
2. Able to analyze characteristics and properties based on impulse response and Fourier analysis.
3. Able to apply the concept of Laplace transforms and its application in network analysis and to evaluate the system function.
4. Able to apply the transformation tools on the analysis of spectral densities, design of system function.

Credits: 4	Core Compulsory
Max. Marks: 25+75	Min. Passing Marks: **40**

Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P: 3-1-0

Unit	Topics	No. of Lectures
I	Introduction of continuous and discrete time signals and their mathematical representation. Classification of signals, Signal energy and power. Even and odd signals. Periodic, exponential and sinusoidal signals. Unit impulse and unit step functions for both discrete and continuous time signals.	15
II	Fourier Series of periodic functions, Even and odd functions, Dirichlets Condition, Wave Symmetry, Fourier series in exponential form, Fourier analysis of half and half wave expansion, Fourier Transform, Properties of Fourier transform, Parseval Theorem, Fourier Transform of Different Functions, Application of Fourier transform in signal analysis.	15
III	Laplace Transform and its existence, Laplace Transform of standard functions, properties of Laplace Transform, Laplace Transform of periodic functions, Laplace Transform of special functions, inverse Laplace Transform, Application of Laplace transform in circuit analysis (R, RC, LC, RLC circuits)	15
IV	Correlation, Auto correlation and Cross correlation function, Convolution. Probability and events, Random signals, Random variable and Random Process, Statistical averages and moments, Probability density function and Power spectral density, Gaussian distribution.	15

Suggested Readings:

1. A text Book of Engineering Mathematics-Manish Goyal and N. P. Bali
2. Principles of Communication system- Taub and Schilling, TMH

3. Advanced Engineering Mathematics by H. K. Das, S. Chand
4. Networks and Systems D. Roy Chaudhary
5. Fourier transformation and Laplace transformation, Schaum Series Book.
6. Alan.V Oppenheim, Signals and Systems, 4th Edition 2007, Pearson Prentice Hall Publication.
7. K.M. Soni, Signals and Systems; 3rd Edition, S.K. Kataria & Sons Publication.
8. P.Ramesh Babu, Signal and Systems, 3rd Edition, Scitech Publications (INDIA) Pvt. Ltd.
9. Simon Haykin, Signals and Systems, 2nd Edition, Willy Publications

This course can be opted as an elective by the students of following subjects

Physics/Computer Science/ Mathematics/Statistics

Suggested Continuous Evaluation Methods:

Total Marks: 25

Internal Test: 10 Marks

Home Assignment/Presentation /Project / Research Orientation/ Term Papers/Seminar: 10 Marks

Class performance/Participation: 5 Marks

Course prerequisites: To study this course, a student must have had the subject Physics/Electronics/Computer Science/ Mathematics/Statistics/Computer Application in B.Sc.

Suggested equivalent online courses:

1. MIT Open Learning - Massachusetts Institute of Technology, https://openlearning.mit.edu/

2. National Programme on Technology Enhanced Learning (NPTEL), https://www.youtube.com/user/nptelhrd

3. Uttar Pradesh Higher Education Digital Library, http://heecontent.upsdc.gov.in/SearchContent.aspx

8. SwayamPrabha - DTH Channel, https://www.swayamprabha.gov.in/index.php/program

Further Suggestions: ……..

Program/Class: Master of Science in Electronics	**Year: First**	**Semester: I**
Subject: Electronics		
Course Code: B140702T	**Course Title: Semiconductor Devices and Circuits**.	

Course Objectives:

The objective of the course is to introduce basic semiconductor devices, their characteristics and application, understand analysis and design of simple diode circuit learn to analyse the PN junction behaviour at the circuit level and its role in the operation of diodes and active device

Course outcomes:

After completion of this course, a student will be able to:
CO1: Ability to analyze PN junctions in semiconductor devices under various conditions.
CO2: Ability to design and analyze simple rectifiers and voltage regulators using diodes..
CO3: Ability to describe the behavior of special purpose diodes.
CO4: Ability to design and analyze simple BJT and MOSFET circuits.

Credits:4	**Core Compulsory**
Max. Marks: 25+75	**Min. Passing Marks: 40**

Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P: 3-1-0

Unit	Topics	No. of Lectures
I	Diode and Applications: Diode - Static and Dynamic resistances, Equivalent circuit, Load line analysis, Diffusion and Transition Capacitances, Diode Applications: Switch-Switching times. Rectifier - Half Wave Rectifier, Full Wave Rectifier, Bridge Rectifier, Rectifiers with Capacitive and Inductive Filters, Clippers-Clipping at two independent levels, Clamper-Clamping Circuit Theorem, Clamping Operation, Types of Clampers.	**15**
II	Bipolar Junction Transistor (BJT): Principle of Operation, Common Emitter, Common Base and Common Collector Configurations, Transistor as a switch, switching times, Transistor Biasing and Stabilization - Operating point, DC & AC load lines, Biasing - Fixed Bias, Self Bias, Bias Stability, Bias Compensation using Diodes.	**15**
III	Junction Field Effect Transistor (FET): Construction, Principle of Operation, Pinch-Off Voltage, VoltAmpere Characteristic, Comparison of BJT and FET, Biasing of FET, FET as Voltage Variable Resistor. Special Purpose Devices: Zener Diode - Characteristics, Voltage Regulator. Principle of Operation - SCR, Tunnel diode, UJT, Varactor Diode FET Amplifiers: Small Signal Model, Analysis of JFET Amplifiers, Analysis of CS, CD, CG JFET Amplifiers. MOSFET Characteristics in Enhancement and Depletion mode, Basic Concepts of MOS Amplifiers.	**15**
IV	Analysis and Design of Small Signal Low Frequency BJT Amplifiers: Transistor Hybrid model, Determination of h-parameters from transistor characteristics, Typical values of h- parameters in CE, CB and CC configurations, Transistor amplifying action, Analysis of CE, CC, CB Amplifiers and CE Amplifier with emitter resistance, low frequency response of BJT Amplifiers, effect of coupling and bypass capacitors on CE Amplifier	**15**

Suggested Readings:

1. Electronic Devices and Circuits- Jacob Millman, McGraw Hill Education
2. Electronic Devices and Circuits theory– Robert L. Boylestead, Louis Nashelsky, 11th Edition, 2009, Pearson.
3. The Art of Electronics, Horowitz, 3rdEdition Cambridge University Press
4. Electronic Devices and Circuits, David A. Bell – 5 th Edition, Oxford.
5. Pulse, Digital and Switching Waveforms –J. Millman, H. Taub and Mothiki S. Prakash Rao, 2Ed., 2008, Mc Graw Hill.

This course can be opted as an elective by the students of following subjects: M.Sc. Physics

Suggested Continuous Evaluation Methods:

Total Marks: 25
House Examination/Test: 10 Marks
Written Assignment/Presentation/Project / Research Orientation/ Term Papers/Seminar: 10 Marks
Class performance/Participation: 5 Marks

Course prerequisites: To study this course, a student must have basic circuit knowledge.

Suggested equivalent online courses:

https://nptel.ac.in/courses/108108112

Further Suggestions: None

At the End of the whole syllabus any remarks/ suggestions: None

Program/Class: Master of Science in Electronics	Year: First	Semester: I
Subject: Electronics		
Course Code: B140703T	**Course Title: Digital System Design**	

Course Objectives: This course is an introduction to the basic principles of digital system design. At the conclusion of this course, the student will be able to quantitatively identify the fundamentals of digital system design, including logic gates, logic and arithmetic subsystems, and integrated circuits. They will gain the practical skills necessary to work with digital circuits through problem solving and hands on laboratory experience with logic gates, encoders, flip-flops, counters, shift registers, adders, etc.

After completion of this course, a student will be able to:

CO1: The student will be able to analyze and design simple logic circuits using tools such as Boolean algebra, Karnaugh Map and Tabulation method.

CO2: The student will able to design different combinational circuits.

CO3: The student will able to design different sequential circuits.

CO4: Ability to understand concept of logic families.

Credits: 4	Core Compulsory
Max. Marks: 25+75	Min. Passing Marks:40

Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P: 3-1-0

Unit	Topics	No. of Lectures
I	Analog & digital signals, AND, OR, NOT, NAND, NOR, XOR & XNOR gates, Boolean algebra, DeMorgan's theorems, Implementation of logical function using only NAND/NOR gates, 1`s complement and 2`s complement, Standard representation of logical functions (SOP and POS forms), K-map representation and simplification of logical function up to five variables, don't care conditions, XOR & XNOR simplifications of K-maps, Tabulation method.	16
II	Adders, Subtractor, Implementation of full adder using half adder, full subtractor using half subtractor, Multiplexer, de-multiplexer, decoder & encoder, code converters, 1- & 2-bit comparators, BCD to seven segment decoder/encoder, Implementation of logic functions using multiplexer/de-multiplexer and decoder, Implementation of 16×1 MUX using 4×1 MUX, 4×16 decoder using 3×8 decoder etc., logic implementations using PROM, PLA & PAL.	16
III	Difference between combinational and sequential circuits, Latch, Flip-flops: SR, JK, D & T flip flops – Truth table, Excitation table, Conversion of flip-flops, race around condition, Master Slave flip flop, Shift registers: SIPO, PISO, PIPO, SIPO, Bi-directional, 4-bit universal shift register; Counters: Asynchronous/ripple & synchronous up/down counters, Ring counter, Johnson counter, sequence detector.	18
IV	Logic families: Special characteristics (Fan out, Power dissipation, propagation delay, noise margin), working of RTL, DTL, TTL, ECL and CMOS families, their advantages and disadvantages.	10

Suggested Readings:

1. Moris Mano, Digital Design, Pearson Education.
2. R. P. Jain, Digital Electronics, Tata McGraw Hill.
3. Thomas L. Floyd, Digital Fundamentals, Pearson Education.
4. Malvino and Leech, Digital Principles & Applications, Tata McGraw Hill

5. William I. Fletche, An Engineering Approach to Digital Design

This course can be opted as an elective by the students of following subjects

Physics/Computer Science/ Mathematics/Statistics

Suggested Continuous Evaluation Methods:

Total Marks: 25

House Examination/Test: 10 Marks

Written Assignment/Presentation/Project / Research Orientation/ Term Papers/Seminar: 10 Marks

Class performance/Participation: 5 Marks

Course prerequisites: To study this course, a student must have had the subject Physics/Electronics/Computer Science/ Mathematics/Statistics in class B.Sc

Suggested equivalent online courses:

1. MIT Open Learning - Massachusetts Institute of Technology, https://openlearning.mit.edu/
2. National Programme on Technology Enhanced Learning (NPTEL), https://www.youtube.com/user/nptelhrd
3. Uttar Pradesh Higher Education Digital Library, http://heecontent.upsdc.gov.in/SearchContent.aspx
8. SwayamPrabha - DTH Channel, https://www.swayamprabha.gov.in/index.php/program

Further Suggestions: ……..

Program/Class: Master of Science in Electronics	**Year: First**	**Semester: I**
Subject: Electronics		
Course Code: B140704T	**Course Title: Programming in C**	

Course Objectives:

The objective of this course module is to acquaint the students with the basics of computer programming, get them familiar with various important features and concepts of C Language and problem-solving using programming in C.

Course outcomes:

At the end of this course, students will be

1. Able to understands the fundamentals of C programming and applications in problem solving.
2. Able to apply control structures and user defined functions for solving the problem
3. Able to apply the array for Strings and string handling operations.
4. Apply skill of identifying appropriate programming constructs for problem Solving.

Credits: 4	**Core Compulsory**
Max. Marks: 25+75	**Min. Passing Marks: 40**

Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P: 3-1-0

Unit	**Topics**	**No. of Lectures**
I	Introduction to computer-based problem solving, Programming language classification: Machine language, Assembly language, high level language, assemblers, compilers, interpreters. History of C, Introduction of C, Basic structure of C program, Concept of variables, constants and data types in C,	15

	Operators and expressions: Introduction, arithmetic, relational, Logical, Assignment, Increment and decrement operator, Conditional, bitwise operators, Expressions, Operator precedence and associativity. Managing Input and output Operation, formatting I/O.	
II	C Statements, conditional executing using if, else, nesting of if, switch and break Concepts of loops, example of loops in C using for, while and do-while, continue and break. Storage types (automatic, register etc.), predefined processor, Command Line Argument.	15
III	One dimensional arrays and example of iterative programs using arrays, 2-D arrays Use in matrix computations. Concept of Sub-programming, functions Example of user defined functions. Function prototype, Return values and their types, calling function, function argument, function with variable number of argument, recursion.	15
IV	Pointers, relationship between arrays and pointers Argument passing using pointers, Array of pointers. Passing arrays as arguments. Strings and C string library. Structure and Union. Defining C structures, Giving values to members, Array of structure, Nested structure, passing strings as arguments. File Handling.	15

Suggested Readings:

1. E Balagurusamy , ANSI C.
2. Yashwant Kanetkar, Let us C, BPB Publications, 2nd Edition, 2001.
3. Herbert Schildt, C:The complete reference, Osbourne Mcgraw Hill, 4th Edition, 2002.
4. V. Raja Raman, "Computer Programming in C", Prentice Hall of India, 1995.
5. Kamthane , Programming with ANSI and Turbo C
6. Deitel , C – How to Program
7. Ritchie, The C Programming Language.
8. K.K.Verma, Nidhi Asthana, Programming in C: A Primer, Shree Publishers, New Delhi

This course can be opted as an elective by the students of following subjects

Physics/Computer Science/ Mathematics/Statistics

Suggested Continuous Evaluation Methods:

Total Marks: 25

Internal Test: 10 Marks

Home Assignment/Presentation /Project / Research Orientation/ Term Papers/Seminar: 10 Marks

Class performance/Participation: 5 Marks

Course prerequisites: To study this course, a student must have had the subject Physics/Electronics/Computer Science/ Mathematics/Statistics/Computer Application in B.Sc.

Suggested equivalent online courses:

1. MIT Open Learning - Massachusetts Institute of Technology, https://openlearning.mit.edu/

2. National Programme on Technology Enhanced Learning (NPTEL), https://www.youtube.com/user/nptelhrd

3. Uttar Pradesh Higher Education Digital Library, http://heecontent.upsdc.gov.in/SearchContent.aspx

8. SwayamPrabha - DTH Channel, https://www.swayamprabha.gov.in/index.php/program

Further Suggestions: ……..

Program/Class: Master of Science in Electronics	Year: First	Semester: I
Subject: Physics (Electronics)		
Course Code: B140705T	**Course Title: Electronic Measurement and Instrumentation.**	

Course Objectives:

The objective of the course is to provide a brief knowledge of measurements and measuring instruments related to Physics and Electronics. The basic idea of this course is to give the sufficient information of measurements in any kind of industry viz. electrical, electronics, mechanical etc.

Course outcomes:

After completion of this course, a student will be able to:
CO1: Ability to analyze quality measurements with different digital display devices.
CO2: Understand the principles of various types of transducers and sensors with their practical application.
CO3: Ability to understand principle of operation of the data acquisition system and its industrial application and working.
CO4: Ability to understand principle of operation, working and applications of waveform analyzers, spectrum analyzers and other display devices

Credits:4	Elective
Max. Marks: 50+50	**Min. Passing Marks: 40**

Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P: 3-1-0

Unit	Topics	No. of Lectures
I	Qualities Measurements and Digital Display Devices: Performance Characteristics, Error in Measurement, Sources of Error, Arithmetic Mean, Deviation from the Mean, Average Deviation, Standard Deviation, Limiting Errors. Digital Display Devices: LED, LCD, Gas Discharge Plasma Displays, Incandescent Display, LVD (Liquid Vapour Display), Printers, Digital Voltmeters, Spectrum Analyzer.	**15**
II	Introduction, Selection Parameters of Transducer, Resistive Transducer, Strain Gauges, Inductive Transducer, Differential Output Transducers, LVDT, Capacitive Transducer, Photo-electric Transducer, Photo cells, Photo-Voltaic Cell, Photo Transistors, Temperature Transducers, Mechanical Transducer.	**15**
III	Data Acquisition and Conversion: Introduction, Objective of Data Acquisition System, Multichannel DAS, A/D and D/A converters using Op-Amp, Data Loggers, Electromechanical A/D Converter, Digital Transducer, Frequency Standards	**15**
IV	Measurement of Power and Frequency: Introduction, Power Measurement by Bolometer element, Bolometer Mount and Bolometer Bridge, Measurement of Power on a Transmission Line, Measurement of Microwave Frequencies, Resonant Coaxial Lines, Cavity Wave meter.	**15**

Suggested Readings:

1. David A. Bell, "Electronic Instrumentation and Measurements", 2nd Ed., PHI, New Delhi 2008.
2. H. S. Kalsi, "Electronic Instrumentation", 3rd Ed., McGraw Hill Education (India),2015

3. AK Sawhney, "Electronic Measurements and Instrumentation
This course can be opted as an elective by the students of following subjects: M.Sc. Physics
Suggested Continuous Evaluation Methods: Total Marks: 50 House Examination/Test: 30 Marks Written Assignment/Presentation/Project / Research Orientation/ Term Papers/Seminar: 10 Marks Class performance/Participation: 10 Marks
Course prerequisites: To study this course, a student must have basic knowledge of Functions, Matrix, Differentiation & Integration.
Suggested equivalent online courses: https://nptel.ac.in/courses/111107105
Further Suggestions: None

At the End of the whole syllabus any remarks/ suggestions: None

Program/Class: Master of Science in Electronics	**Year: First**	**Semester: I**
Subject: Electronics		
Course Code: B140706T	**Course Title: Physics of Electronic Materials**	
Course Objectives:		
The objective of the course is to give in-depth knowledge of electronic material that are used in electronics equipments, magnets, transmission lines.		
Course outcomes:		
After completion of this course, a student will be able to: CO1: Ability to analyze the lattice structure of crystals. CO2:Ability to have knowledge of semiconductors and their properties at different temperatures and electric fields. CO3:The student will have knowledge of Dielectrics, their behaviour in electric and magnetic field and their uses in transformer. CO4:To have a knowledge of new class of a conductors called super conductors used for high power transmission and also of liquid crystals which are used in display panels.		
Credits:4	**Elective**	
Max. Marks: 25+75	**Min. Passing Marks: 40**	
Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P: 3-1-0		

Unit	Experiment	No. of Lectures
I	Space lattices and Crystal structures, Crystal directions and planes, Crystalline state and non-crystalline states, Bonding in solids, reciprocal lattice, Miller indices, Miller-Bravais lattice ,Fundamentals of Polymers	15
II	Types of Semiconductors, Compound semiconductor, Direct and indirect semiconductor, carrier concentration, Intrinsic conductivity and mobility, variation of carrier, concentration with temperature,	15

	determination of band gap of intrinsic semiconductor, kinetics of, extrinsic case, Hall effects in semiconductors, Degenerate semiconductors	
III	Dielectrics, Parameters for dielectrics (Dielectric constant, dipole moment, polarization, polarisability), mechanism of polarization. Permanent dipole moment, Space charge polarization, Internal field and its expression, Clausius Mossotti relation, Maxwell relation, Debye's quantization of Clausius Mossotti equation, polar and non-polar solids, classification of dielectrics, piezoelectric, pyroelectric, Ferroelectric, Para electric and ferromagnetic materials, Ferromagnetic domain, Real and imaginary dielectric constants, Dielectric losses, Effect of frequency and polarization.	15
IV	Superconductivity, Different Properties of Superconductor, Meissner effect, London equation, BCS theory, Josephson effect, High Temperature Superconductor, Liquid Crystals and types of liquid crystals.	15

Suggested Readings:

1. Raghvan, A First Course In Material Science, Mac-Graw Hill
2. Mermin and Ashcroft, Solid State Electronics
3. O. N. Srivastava and A. R. Verma, A first Course in crystallography by
4. S. Chandrsekhar, Liquid Crystals by
5. R.E. Hummel, Electronic Properties of Materials:
6. David Jiles, Electronic Properties of Materials
7. S. K. Ghandhi, VLSI fabrication principles:
8. S. M. Dhir, Electronic components & materials principles, manufacturing, maintenance
9. S. O. Kasap, Principle of electronic material and devices – TMH
10. Jacob Millman, Electronic Devices and Circuits, McGraw Hill Education
11. Robert L. Boylestead, Louis Nashelsky, Electronic Devices and Circuits theory, Pearson.
12. Horowitz, The Art of Electronics, Cambridge University Press.

This course can be opted as an elective by the students of following subjects:

Suggested Continuous Evaluation Methods:

Total Marks: 25
House Examination/Test: 10 Marks
Written Assignment/Presentation/Project / Research Orientation/ Term Papers/Seminar: 10 Marks
Class performance/Participation: 5 Marks

Course prerequisites: To study this course, a student must have basic circuit knowledge.

Suggested equivalent online courses:

https://nptel.ac.in/courses/108108112

Further Suggestions: None

At the End of the whole syllabus any remarks/ suggestions: None

Program/Class: Master of Science in Electronics	Year: First	Semester: I
Subject: Electronics		
Course Code: B140707P	**Course Title:** Electronics Laboratory Course -I (A)	
Course Objectives:		
The objective of the Laboratory is to provide practical exposure of basic logic gates and design of various combinational and sequential logic gates. The objective of C programming laboratory is to provide the understanding of programming using C. The objective of electronic circuit lab is to provide students the knowledge of circuits operation and characteristics.		
Course outcomes:		
After completion of this course, a student will be able to: CO1: To enable students to design arithmetic and logic circuits design. CO2:The student will be able to design sequential logic circuits which are used in computer. CO3:The student will learn about the C programming. CO4:The student will be able to design amplifiers and oscillators using transistors which are part of Electronic gadgets which are used day-to-day life.		
Credits:5	**Core Compulsory**	
Max. Marks: 50+50	**Min. Passing Marks: 40**	
Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P: 0-0-10		

Group	Experiment	No. of Lectures
I	**Digital Electronics Lab** 1. To study and verify the truth table of all basic gate and universal gates 2. a. To design all logic gates using NAND gate and verify truth table. b. To design all logic gates using NOR gate and verify truth table. 3. To design the circuit & verify the truth table for a. Half and full adder using NAND gate only. b. Half and full subtractor using NAND gate only. 4. To implement control circuit using multiplexer 4. To design a circuit & verify the truth table of Gray to Binary and Binary to Gray converter code converter 5. To design a circuit & verify the truth table for a. SR Flip-flop b. JK Flip-flop c. Master slave JK Flip-flop 6. To design & verify the truth table for 4-Bit Ripple Up Counter. 7. To design & verify the truth table for 4-Bit synchronous Up Counter. 8. Open ended experiment –A. 9. Open ended experiment –B.	**50**
II	**Electronic Circuits Lab.** 1. To Draw characteristics curve of Field Effect Transistor (FET) and calculate its parameters.	**50**

	2. To Draw characteristics curve of n channel and p channel enhancement MOSFET. 4. To study the frequency response of two stage transistorized RC coupled Amplifier and observe the loading effect of stage Two on stage One. 5. Find the wave shape and frequency of a stable multivibrator with different combination. 6. Open ended experiment –A.	
III	**C Programming Lab** 1. Write a program to sum of five digits. 2. Write a program to input a number and print in binary equivalent. 3. Write a program to calculate factorial of n random numbers. 4. Write a program to find transpose of a matrix. 5. Write a program that return sum of element stored in any array. 6. Write a program to find the length of a string using a pointer. 7. Open ended experiment -A 8. Open ended experiment –B 9. Open ended experiment -C 10. Open ended experiment –D	**50**

Suggested Readings:

1. Jain, Modern Digital Electronics, 2/e , TMH
2. Morries Mano, Digital Logic Design-, PHI.
3. Yashwant Kanetkar, Let us C, BPB Publications, 2nd Edition, 2001.
4. Herbert Schildt, C: The complete reference, Osbourne Mcgraw Hill, 4th Edition, 2002.
5. V. Raja Raman, "Computer Programming in C", Prentice Hall of India, 1995
6. Jacob Millman, and C. C. Halkias, "Electronic devices and circuits", TMH Publications.
7. Donald P Leach, Albert Paul Malvino, Digital Principle and Applications, Seventh Edition, TMH, Publications.
8. Mottershead, Electronic Devices and circuits; An Introduction Prentice Hall of India Private, Limited (PHI), New Delhi

This course can be opted as an elective by the students of following subjects:

Suggested Continuous Evaluation Methods:

Total Marks: 50
Lab Record File (depending upon the no. of experiments performed out of the total assigned experiments): 20
marks for Viva Voce/Performance: 20
Class Interaction: 10

Course prerequisites: To study this course, a student must have basic circuit knowledge.

Suggested equivalent online courses:

https://nptel.ac.in/courses/108108112

Further Suggestions: None

At the End of the whole syllabus any remarks/ suggestions: None

Program/Class: Master of Science in Electronics	Year: First	Semester: I
Subject: Electronics		
Course Code: B140708P	**Course Title:** Electronics Laboratory Course -I (B)	
Course Objectives:		
The objective of the Laboratory is to provide practical exposure of basic logic gates and design of various combinational and sequential logic gates. The objective of C programming laboratory is to provide the understanding of programming using C. The objective of electronic circuit lab is to provide students the knowledge of circuits operation and characteristics.		
Course outcomes:		
After completion of this course, a student will be able to: CO1: To enable students to design arithmetic and logic circuits design. CO2:The student will be able to design sequential logic circuits which are used in computer. CO3:The student will learn about the C programming. CO4:The student will be able to design amplifiers and oscillators using transistors which are part of Electronic gadgets which are used day-to-day life.		
Credits:4	**Elective**	
Max. Marks: 50+50	**Min. Passing Marks: 40**	
Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P: 0-0-10		

Group	Experiment	No. of Lectures
I	**Digital Electronics Lab** 1. To study and verify the truth table of all basic gate and universal gates 2. a. To design all logic gates using NAND gate and verify truth table b. To design all logic gates using NAND gate and verify truth table. 3. To design the circuit & verify the truth table for a. Half and full adder using NOR gate only. b. Half and full subtractor using NOR gate only. 4. To implement control circuit using multiplexer 4. To design a circuit & verify the truth table of Excess-3 to Binary & Binary to Excess-3 converter code converter 5. To design a circuit & verify the truth table for a. SR Flip-flop b. D Flip-flop c. Master slave JK Flip-flop 6. To design & verify the truth table for 4-Bit Ring Counter. 7. To design & verify the truth table for 4-Bit Asynchronous Up Counter. 8. Using Transisitor, Diode and Resistor implement two input NAND gate. 9. Open ended experiment –A. 10. Open ended experiment –B.	**50**
II	**Electronic Circuits Lab.**	**50**

	1. To Draw characteristics curve of Field Effect Transistor (FET) and calculate its parameters. 2. To Draw characteristics curve of n channel and p channel enhancement MOSFET. 3. To study and plot the frequency response curve of the negative feedback in voltage and current shunt using BJT. 4. To study the frequency response of transistorized RC coupled Amplifier. 5. Characteristics of SCR. 6. Find the wave shape and frequency of a mono stable multivibrator with different combination. 7. Open ended experiment –A. 8. Open ended experiment –B.	
III	**C Programming Lab** 1.Write a program to determine simple interest. 2. Write a program to input a number and print in hexadecimal equivalent 3.Write a program to calculate factorial of a given number. 4.Write a program to find largest number in three given numbers. 5.Write a program that return sum of element stored in any array. 6.Write a program to find the length of a string using a pointer. 7.Open ended experiment -A 8.Open ended experiment –B 9.Open ended experiment -C 10.Open ended experiment –D	**50**

Suggested Readings:

9. Jain, Modern Digital Electronics, 2/e , TMH
10. Morries Mano, Digital Logic Design-, PHI.
11. Yashwant Kanetkar, Let us C, BPB Publications, 2nd Edition, 2001.
12. Herbert Schildt, C: The complete reference, Osbourne Mcgraw Hill, 4th Edition, 2002.
13. V. Raja Raman, "Computer Programming in C", Prentice Hall of India, 1995
14. Jacob Millman, and C. C. Halkias, "Electronic devices and circuits", TMH Publications.
15. Donald P Leach, Albert Paul Malvino, Digital Principle and Applications, Seventh Edition, TMH, Publications.
16. Mottershead, Electronic Devices and circuits; An Introduction Prentice Hall of India Private, Limited (PHI), New Delhi

This course can be opted as an elective by the students of following subjects:

Suggested Continuous Evaluation Methods:

Total Marks: 50
Lab Record File (depending upon the no. of experiments performed out of the total assigned experiments): 20
marks for Viva Voce/Performance: 20
Class Interaction: 10

Course prerequisites: To study this course, a student must have basic circuit knowledge.

Suggested equivalent online courses:

https://nptel.ac.in/courses/108108112

Further Suggestions: None

At the End of the whole syllabus any remarks/ suggestions: None

M.Sc Electronics Second Semester

Program/Class: Master of Science in Electronics	Year: First	Semester: II
Subject: Electronics		
Course Code: B140801T	**Course Title: Network Analysis and Synthesis**	
Course Objectives:		
The course intends to make the students proficient in analyzing circuits and synthesis of one port network. At the completion of the course, the student should be able to analyze the circuit using, KVL, KCL, loop analysis, graph theory and application of network theorems in analysis of circuit.		
Course outcomes:		
At the end of this course, students will be able to 1. Apply network concepts of network analysis in the formulation and solution of electric network problems. 2. Understand the properties and characteristics of network functions, and verify the mathematical constraints for their physical implementation. 3. Understand two-port network analysis in the design and analysis networks. 4. Synthesize passive one-port networks using standard Foster and Cauer forms.		
Credits:5	**Core Compulsory**	
Max. Marks: 25+75	**Min. Passing Marks: 40**	
Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P: 4-1-0		

Unit	Topics	No. of Lectures
I	Classification of circuits, sources and signals, standard signals, Circuit elements, Passive and Active circuit elements, concept of ideal voltage and current sources, source transformations, Circuit Principles: Ohm's Law, Kirchoff's Current Law, Kirchoff's Voltage Law Network, Nodal Analysis, Loop analysis, Transient response of dc and ac networks, Linear constant coefficient differential equations, time domain analysis of simple RL, RC, RLC, Solution of network equations using Laplace transform; sinusoidal steady – state analysis, relation between impulse response and system function.	15
II	Network theorems and their applications-Superposition, reciprocity, Thevenin, Norton, Maximum power transfer, Millman, Substitution, Compensation and Tellegan's theorem.	12
III	Network topology, graph, types of graphs, sub-graph, tree, link, twig incidence matrices, Fundamental Tie set matrix, Fundamental cut set matrix, formulation and solution of circuit equations based on graph theory using different analysis techniques, Concept of duality.	14
IV	Network Functions: Driving point and transfer functions, property of driving point and transfer function, Networks function of one port and two port networks, two port network parameters- z-, y-, T-, h-parameters, Inter-relations among parameters, Condition for reciprocity and symmetry, Interconnections of two port networks, concepts of poles and zeros, , Time domain behavior of pole-zero plot,	18
V	Network synthesis- Synthesis problem formulation, Hurwitz polynomials, properties of positive real functions, properties of RC, LC and RL driving point functions, Foster and Cauer synthesis of LC and RC circuits	16

Suggested Readings:

1. M.E. Valkenburg, "Network analysis", PHI.
2. D. R. Choudhary, "Networks and Systems", New Age International.
3. K.M. Soni, "Circuits and Systems", VIII Edition, S.K. Kataria & Sons Delhi
4. A. Chakarbarti, Circuit Theory, Dhanpat Rai and Co. (P) Ltd.
5. A. Sudhakar, Circuits and Networks, Tata McGraw
6. K.S. Suresh Kumar, Electrical circuits and Networks, Pearson Education,
7. Bhise, Chadda, Kulshreshtha, "Engineering network analysis and filter design", Umesh Publication.
8. F.F. Kuo, "Network Analysis and Synthesis", Wiley India Pvt. Ltd.
9. Temes & LaPatra – Introduction to circuit Synthesis & Design, McGraw Hill.
10. Behrouz Peikari, "Fundamentals of Network Analysis & synthesis", Jaico Publishing House

This course can be opted as an elective by the students of following subjects

Physics/Computer Science/ Mathematics/Statistics

Suggested Continuous Evaluation Methods:

Total Marks: 25

Internal Test: 10 Marks

Home Assignment/Presentation /Project / Research Orientation/ Term Papers/Seminar: 10 Marks

Class performance/Participation: 5 Marks

Course prerequisites: To study this course, a student must have had the subject Physics/Electronics/Computer Science/ Mathematics/Statistics/Computer Application in B.Sc

Suggested equivalent online courses:

1. MIT Open Learning - Massachusetts Institute of Technology, https://openlearning.mit.edu/

2. National Programme on Technology Enhanced Learning (NPTEL), https://www.youtube.com/user/nptelhrd

3. Uttar Pradesh Higher Education Digital Library, http://heecontent.upsdc.gov.in/SearchContent.aspx

8. SwayamPrabha - DTH Channel, https://www.swayamprabha.gov.in/index.php/program

Further Suggestions: ……..

Program/Class: Master of Science in Electronics	**Year: First**	**Semester: II**
Subject: Electronics		
Course Code: B140802T	**Course Title: Microprocessor and Microcontrollers**	

Course Objectives:

This course deals with the systematic study of the Architecture and programming issues of 8085 and 8086 microprocessor family This also aim to provide the students with a basic understanding of instruction sets & assembly language programming of 8085/8086 processor. The course also aims to study of architecture of 8051 microcontroller and its application. This course will will provide sufficient knowledge to students about basic knowledge of the above microprocessor and system needed to develop the systems using it.

Course outcomes:

At the end of this course, students will be

1. Acquired knowledge about 8085 Microprocessor and supporting devices.
2. Able to write the assembly language programming using 8085 microprocessor.
3. Acquired knowledge about 8086 Microprocessor and also develop programming skill related to 8086 Microprocessor,

4. Students will be able to understand the concept and scope of 8051 microcontrollers, programming, interfacing of various external I/O devices, communication protocols used by microcontrollers and embedded system design.
5. Able to design microprocessor/microcontroller-based system using different peripheral devices.

Credits: 5	**Core Compulsory**
Max. Marks: 25+75	**Min. Passing Marks: 40**

Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P: 4-1-0

Unit	Topics	No. of Lectures
I	Introduction to Microprocessors and microcomputers, Study of 8-bit Microprocessor, 8085 pin configuration, Internal Architecture and operations, interrupts, Stacks and subroutines, addressing modes, Introduction to 8085 instructions set, advance 8085 programming, Counters and time Delays, Instruction cycle, machine cycle, T-states, timing diagram for 8085 instructions.	20
II	Block diagram and architecture of 8086 family, Execution unit, Bus Interface Unit, flags and register Organization, Physical Memory Organization, concept of memory segmentation, 8086 pin configuration, addressing modes of 8086 Instruction set and introduction to programming of 8086.	18
III	I/O interfacing and data transfer schemes, Interfacing with input/output devices (memory mapped, peripheral I/O), architectural details and study of peripheral devices 8255, 8253, 8257, 8259, 8251, IEEE 488 and RS232C	17
IV	Overview of 8051microcontroller family, the 8051 Architecture, 8051 Microcontroller Hardware, Input / Output Pins, Ports, Memory Organization, Special Function Registers, Timers/Counters, Serial Port Interface, Interrupt Structure, Addressing Modes, basic instructions, and introduction to programming of 8051.	20

Suggested Readings:

1. Ramesh. S. Gaonkar, “Microprocessor architecture Programming and Application with 8085” Penram International Publishing, 4th Edition.
2. Douglas V Hall. Microprocessor Interfacing, Tata Mc Hill.
3. B. Ram, “Fundamentals of microprocessors and microcomputer” Dhanpat Rai, 5th Edition.
4. Y.C. Liu and G.A. Gibson: Microcomputer Systems: The 8086/8088 Family Architecture.
5. M. Rafiquzzaman, “Microprocessor Theory and Application” PHI – 10th Indian Reprint.
6. R. Singh and B. P. Singh: Microprocessor Interfacing and Application, New Age International Publishers, 2nd Edition. 2. V. Hall: Microprocessors Interfacing, TMH (2ndEdition).
7. Kenneth J Ayala, The 8051Microcontroller, Penram International Publishing.
8. M.A. Mazidi and J. G. Mazidi, 2004 “The 8051 Microcontroller and Embedded Systems”, PHI.
9. R. Kamal, "Embedded Systems: Architecture, Programming & Design", 2007, McGraw Hill, USA 2007.
10. Dr. Rajiv Kapadia, “8051 Microcontroller & Embedded Systems”, Jaico Press

This course can be opted as an elective by the students of following subjects

Physics/Computer Science/ Mathematics/Statistics

Suggested Continuous Evaluation Methods:

Total Marks: 25

Internal Test: 10 Marks

Home Assignment/Presentation /Project / Research Orientation/ Term Papers/Seminar: 10 Marks Class performance/Participation: 5 Marks
Course prerequisites: To study this course, a student must have had the subject Physics/Electronics/Computer Science/ Mathematics/Statistics/Computer Application in class B.Sc.
Suggested equivalent online courses: **1.** MIT Open Learning - Massachusetts Institute of Technology, https://openlearning.mit.edu/ 2. National Programme on Technology Enhanced Learning (NPTEL), https://www.youtube.com/user/nptelhrd 3. Uttar Pradesh Higher Education Digital Library, http://heecontent.upsdc.gov.in/SearchContent.aspx 4. SwayamPrabha - DTH Channel, https://www.swayamprabha.gov.in/index.php/program
Further Suggestions: ……..

Program/Class: Master of Science in Electronics	**Year: First**	**Semester: II**
Subject: Electronics		
Course Code: B140803T	**Course Title: Electromagnetic Theory and Antenna**	
Course Objectives:		
This course provides a general introduction to the important physical concepts and mathematical methods used in treating all types of wave phenomena, but stresses electromagnetic signal propagation. This is also providing compressive knowledge of electromagnetism and its application in modern communications such as wireless, guided wave principles such as fiber optics. This course also provide a thorough introduction to antenna systems with an in depth study of various types & performance parameters for antenna.		
Course outcomes: At the end of this course, students will be 1. Able to learn Maxwell's equations to understand boundary conditions of time varying fields. 2. Able to understand how EM waves will propagate in free space and their characteristics at the boundary between media. 3. Become familiar with the characteristics of transmission lines and their equivalent circuits and learn parameters and transmission line equations. 4. Able to insight into the derivation of field quantities of various antennas and there by deducing the other quantities like gain, directivity, impedance etc.		
Credits: 5	**Core Compulsory**	
Max. Marks: 25+75	**Min. Passing Marks: 40**	
Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P: 4-1-0		

Unit	**Topics**	**No. of Lectures**
I	The equation of continuity for time varying field. Maxwell's equations, EM waves in homogenous medium, conducting medium and dielectrics, pointing theorem, interpretation of ExH, complex pointing vector.	20
II	Propagation of EM wave through Line, Differential equation of the line and their steady state solution; Distortion –less lines, Input impedance of a loss line, Open and short-circuited lines, Reflection coefficient and standing wave ratio; Smith chart and their uses; Impedance matching.	18
III	Propagation of EM wave through tubes, Wave equation in tubes	17

	and its solution for boundary medium, Propagation characteristics of TE and TM mode in rectangular wave guide, Idea of circular wave guide. Propagation of Radio Waves. Surface Wave, Space Wave, Troposcatter and Ionospheric Propagation, Duct Propagation, Radio Horizon, Line of Sight, Fading.	
IV	Basic antenna concept, parameters (patterns, beam area, radiation intensity, beam efficiency, directivity and again, effective aperture, scattering aperture, physical aperture, effective height), Friis transmission formula, duality of antenna, centre fed dipole antenna, antenna field zones. Yagi-Uda antenna, horn antenna, short dipole antenna, antenna arrays and parabolic reflectors. Micro- strip antenna, its types, properties and applications.	20

Suggested Readings:

1. Griffiths: Introduction to Electrodynamics
2. Fawwaz T. Ulaby: Fundamentals of Applied Electromagnetics
3. Hayt, William H., Buck, John A. Hayt, William H., Buck, John A., Engineering Electromagnetics
4. Jordan Edwards C. and Balmain Keith G.S "Electromagnetic Waves and Radiating Systems"/ Prentice Hall (India)
5. Prasad, K.D./ "Antennas and Wave Propagation"/ Khanna Publications
6. A. K. Gautam /" Antennas and Wave Propagation"/ Kataria and Sons
7. J. D. Kraus, Electromagnetics, McGraw Hill.
8. Microwave devices and circuits: S. Y. Liao, Prentice Hall.
9. Ram Kripal, Electromagnetic Field Theory and Application.

This course can be opted as an elective by the students of following subjects

Physics/Computer Science/ Mathematics/Statistics

Suggested Continuous Evaluation Methods:

Total Marks: 25

Internal Test: 10 Marks

Home Assignment/Presentation /Project / Research Orientation/ Term Papers/Seminar: 10 Marks

Class performance/Participation: 5 Marks

Course prerequisites: To study this course, a student must have had the subject Physics/Electronics/Computer Science/ Mathematics/Statistics/Computer Application in class B.Sc.

Suggested equivalent online courses:

1. MIT Open Learning - Massachusetts Institute of Technology, https://openlearning.mit.edu/

2. National Programme on Technology Enhanced Learning (NPTEL), https://www.youtube.com/user/nptelhrd

3. Uttar Pradesh Higher Education Digital Library, http://heecontent.upsdc.gov.in/SearchContent.aspx

4. SwayamPrabha - DTH Channel, https://www.swayamprabha.gov.in/index.php/program

Further Suggestions: ……..

Program/Class: Master of Science in Electronics	Year: First	Semester: II
Subject: Electronics		
Course Code: B220804T	**Course Title:** Introduction with MATLAB	

Course Objectives:

The objective of this course is to impart knowledge of MATLAB and its application in computing. This course will provide opportunities for learning of programing and simulation aspects of MATLAB.

Course outcomes:

After completion of this course, a student will be able to:
CO1: Describe the Introduction to MATLAB.
CO2: Apply matrix manipulations and perform different types of operations on matrices
CO3: Applications of statistics & probability in real life domain.
CO4: Learn statistical techniques through different tools and apply it to case studies using the concepts learned in the class.

Credits: 5	Elective
Max. Marks: 25+75	**Min. Passing Marks: 40**

Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P: 4-1-0

Unit	Topics	No. of Lectures
I	Introduction to MATLAB, MATLAB windows, Input-output, File types, Platform dependence, General commands, Creating and Working with Arrays of Numbers, Creating and Printing Simple Plot, change in axes and annotation, multiple plots, Creating, Saving, and Executing a Script File, Editing, saving m-files, Creating and Executing a Function File, introduction to some inbuilt functions.	**18**
II	Flow control using various statements and loops including For-End and While-End loops with Break commands. Conditional Statements: If-End statement, If-Else-End statement. Scripts and user defined functions, calling functions into a script, subfunctions, and nested functions, concept of local and global variable.	**20**
III	Vector and Matrix generation, subscripting and the colon notation, matrix and array operations and their manipulations, arithmetic operators, relational operators, logical operators, solution of matrix equation, Inverse of Matrix, Eigen values and Eigen Vectors, Determinant, Elementary math functions, Matrix functions,	**17**
IV	Two & three-dimensional graphics: basic plots, change in axes and annotation, multiple plots, saving and printing, mesh plots, surface plots and their variants, data representation, Introduction Of GUI, GUI Component Design, Introduction to Simulink.	**20**

Suggested Readings:

1. Applied Numerical Methods with Matlab for Engineers and Scientists by Steven Chapra, McGraw Hill, 2008.
2. MATLAB: An introduction with applications: Amos Gilat, 5th Edition, Wiley India, 2014.

3. Getting Started with MATLAB: A Quick Introduction for Scientists and Engineers by RudraPratap, Oxford University Press, 2016
This course can be opted as an elective by the students of following subjects: M.Sc. Physics
Suggested Continuous Evaluation Methods: Total Marks: 25 House Examination/Test: 10 Marks Written Assignment/Presentation/Project / Research Orientation/ Term Papers/Seminar: 10 Marks Class performance/Participation: 5 Marks
Course prerequisites: To study this course, a student must have basic knowledge of Functions, Matrix, Differentiation & Integration.
Suggested equivalent online courses: https://nptel.ac.in/courses/111107105
Further Suggestions: None

At the End of the whole syllabus any remarks/ suggestions: None

Program/Class: Master of Science in Electronics	**Year: First**	**Semester: II**
Subject: Electronics		
Course Code: B140805T	**Course Title: Introduction to IoT**	
Course Objectives:		
The objective of the course is to understand the introduce the concept of IoT, Controllers, Sensors and inter-related communication protocols. This course aims to develop student skill in the field of IoT.		
Course outcomes:		
After completion of this course, a student will be able to: CO1: To understand basics IoT. CO2: To understand basics of controllers and sensors. CO3: Understanding of communication protocols related to IoT based systems. CO4: Proficiency in system design issues related to IoT based systems.		
Credits: 5	**Elective**	
Max. Marks: 25+75	**Min. Passing Marks: 40**	
Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P: 4-1-0		

Unit	Topics	No. of Lectures
I	Introduction: Overview of Internet of Things (IoT), the characteristics of devices and applications in IoT ecosystem, Architecture and Classifications, IoT Enabling Technologies, Machine-to-Machine Communications, Difference between IoT and M2M Communications, IoT levels, IoT design methodology, The Physical Design/Logical Design of IoT, Functional blocks of IoT.	**20**
II	Sensors, Actuators and Microcontrollers: Sensor - Measuring physical quantities in digital world e.g. light sensor, moisture sensor, temperature sensor, etc., Actuator – moving or controlling system e.g. DC motor, different type of actuators, Controller – Role of microcontroller as gateway to interfacing sensors and, actuators, microcontroller vs microprocessor,	**18**

	different type of microcontrollers in embedded ecosystem.	
III	Integrating Arduino with Peripherals for IoT applications: Arduino IDE, Input and Output devices, Analog and Digital sensors, Actuators, Programming Arduino for interface with IR sensor, photodiode, Temperature sensor, DC motor, relays for interacting with cloud network using WiFi and with other nearby devices using Bluetooth communication technologies.	**17**
IV	Applications of IoT: Smart Cities, Smart Homes, Surveillance applications, Vehicular IoT, Smart Lighting System, Weather Monitoring System, Smart Agriculture, Healthcare System, Industry applications	**20**

Suggested Readings:

1. Arshdeep Bahga, Vijay Madisetti, "Internet of Things-A Hands on Approach", University of Penn,
2. Adrian McEwen & Hakim Cassimally, "Designing the Internet of Things", ISBN 978-81-265-5686-1 Wiley Publication.
3. Pethuru Raj and Anupama C. Raman, "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", CRC Press, Taylor & Francis Group, 2017.
4. Daniel Kellmereit, "The Silent Intelligence: The Internet of Things", 2013, ISBN: 098997370

This course can be opted as an elective by the students of following subjects: M.Sc. Physics

Suggested Continuous Evaluation Methods:

Total Marks: 25
House Examination/Test: 10 Marks
Written Assignment/Presentation/Project / Research Orientation/ Term Papers/Seminar: 10 Marks
Class performance/Participation: 5 Marks

Course prerequisites: To study this course, a student must have known programming. If the students have done introductory courses on probability theory and linear algebra it would be helpful.

Suggested equivalent online courses:

1.MIT Open Learning - Massachusetts Institute of Technology, https://openlearning.mit.edu/
2. National Programme on Technology Enhanced Learning (NPTEL), https://www.youtube.com/user/nptelhrd
3. Uttar Pradesh Higher Education Digital Library, http://heecontent.upsdc.gov.in/SearchContent.aspx
4. SwayamPrabha - DTH Channel, https://www.swayamprabha.gov.in/index.php/program

Further Suggestions: None

At the End of the whole syllabus any remarks/ suggestions: None

Program/Class: Master of Science in Electronics	Year: First	Semester: II
Subject: Electronics		
Course Code: B140806P	**Course Title:** Electronics Laboratory Course -II (A)	
Course Objectives:		
The objective of the Laboratory is to introduce the practical aspect of Network theory its characteristics and uses in IC. The objective of microprocessor is to provide awareness of programming of 8085and 8086.		
Course outcomes:		
After completion of this course, a student will be able to: CO1: To make the students proficient in analyzing electrical circuits using different network theorems & parameters. CO2: To analyse various circuit parameters and their interconnection. CO3: The student will be able to know about the programming of microprocessor. CO4: The student will be able to know about the applications of microprocessor.		
Credits:4	**Elective**	
Max. Marks: 25+75	**Min. Passing Marks: 40**	
Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P: 0-0-4		

Group	Experiment	No. of Lectures
I	Network Analysis Experiments 1. (a) To Study Superposition Theorem (b) To Study Thevenin's Theorem 2. (a) To Study Maximum Power Transfer Theorem. (b) To verify Tellegen's Theorem in a given network 3. To determine the Z- and Y parameters of a network. 4. To design series-series connections and determine its Z parameters. 5. Open ended experiment –A. 6. Open ended experiment –B.	**75**
II	Microprocessor 1.Write an Assembly language program using 8085 Microprocessor: a. Addition of two 8-bit numbers. b. Addition of two 16-bit numbers. 2. Write an Assembly language program using 8085 Microprocessor Subtraction of two 8-bit numbers: a. Using 'SUB' instruction. b. Using 1's Complement c. Using 2's Complement. 3. Write an Assembly language program using 8085 Microprocessor for Addition and Subtraction of two BCD numbers. 4.Write an Assembly language program using 8085 Microprocessor for Multiplication and Division of two 8-bit numbers.	**75**

	5.Write an Assembly language program using 8085 Microprocessor for to transfer block of data from one memory location to other. 6. Write an Assembly language program using 8085 Microprocessor for to find the largest and smallest number in an array of data. 7.Write following Assembly language program using 8086 Microprocessor: a. Addition of two 16-bit numbers. b. Addition of two 32-bit numbers. 8.Write an Assembly language program using 8085 Microprocessor to perform Subtraction of two 16-bit numbers: a. Using 'SUB' instruction. b. Using 1's Complement c. Using 2's Complement 9.Write an Assembly language program using 8086 Microprocessor for Addition and Subtraction of two BCD numbers. 10.To perform Multiplication of two 16-bit numbers using 8086 microprocessors. 11.To perform Division of two 16-bit numbers using 8086 microprocessors. 12.Write an Assembly language program using 8086 Microprocessor for to transfer block of data from one memory location to other. 1. Open ended experiment –A. 2. Open ended experiment –B.	

Suggested Readings:

1. Ramakant A. Gayakwad, Op-Amps and Linear Integrated Circuits, Fourth Edition By Pearson
2. Operational Amplifiers Theory and Design by Johan Huijsing , Springer
3. Fundamentals of Microprocessor and Microcomputer: B. Ram.
4. Microprocessor Architecture Programming and Application : R.S. Goanker.
5. Introduction to microprocessor : A.P. Mathur.

This course can be opted as an elective by the students of following subjects:

Suggested Continuous Evaluation Methods:

Total Marks: 50

Lab Record File (depending upon the no. of experiments performed out of the total assigned experiments): 20

marks for Viva Voce: 20

Class Interaction: 10

Course prerequisites: To study this course, a student must have basic circuit knowledge.

Suggested equivalent online courses:

https://nptel.ac.in/courses/108108112

Program/Class: Master of Science in Electronics	Year: First	Semester: II
Subject: Electronics		
Course Code: B140807P	**Course Title:** Electronics Laboratory Course -II (B)	
Course Objectives:		
The objective of the Laboratory is to introduce the practical aspect of Network theory its characteristics and uses in IC. The objective of microprocessor is to provide awareness of programming of 8085and 8086.		
Course outcomes:		
After completion of this course, a student will be able to: CO1: To make the students proficient in analyzing electrical circuits using different network theorems & parameters. CO2: To analyse various circuit parameters and their interconnection. CO3: The student will be able to know about the programming of microprocessor. CO4: The student will be able to know about the applications of microprocessor.		
Credits:5	**Elective**	
Max. Marks: 25+75	**Min. Passing Marks: 40**	
Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P: 0-0-4		

Group	Experiment	No. of Lectures
I	Network Analysis Experiments 1. (a) To Study Thevenin's Theorem. (b) To Study Norton's theorem. 2. (a) To Study Reciprocity theorem. (b) To verify Tellegen's Theorem in a given network 3. To determine the Z- and h parameters of a network. 4. To design series-series connections and determine its Z parameters. 5. Open ended experiment –A. 6. Open ended experiment –B.	**75**
II	Microprocessor 6.Write an Assembly language program using 8085 Microprocessor: c. Addition of two 8-bit numbers. d. Addition of two 16-bit numbers. 7. Write an Assembly language program using 8085 Microprocessor Subtraction of two 8-bit numbers: d. Using 'SUB' instruction. e. Using 1's Complement f. Using 2's Complement. 8. Write an Assembly language program using 8085 Microprocessor for Addition and Subtraction of two BCD numbers. 9.Write an Assembly language program using 8085 Microprocessor for Multiplication and Division of two 8-bit numbers.	**75**

	10. Write an Assembly language program using 8085 Microprocessor for to transfer block of data from one memory location to other. 6. Write an Assembly language program using 8085 Microprocessor for to find the largest and smallest number in an array of data. 7.Write following Assembly language program using 8086 Microprocessor: c. Addition of two 16-bit numbers. d. Addition of two 32-bit numbers. 8.Write an Assembly language program using 8085 Microprocessor to perform Subtraction of two 16-bit numbers: d. Using 'SUB' instruction. e. Using 1's Complement f. Using 2's Complement 9.Write an Assembly language program using 8086 Microprocessor for Addition and Subtraction of two BCD numbers. 10.To perform Multiplication of two 16-bit numbers using 8086 microprocessors. 11.To perform Division of two 16-bit numbers using 8086 microprocessors. 12.Write an Assembly language program using 8086 Microprocessor for to transfer block of data from one memory location to other. 3. Open ended experiment –A. 4. Open ended experiment –B.	

Suggested Readings:

6. Ramakant A. Gayakwad, Op-Amps and Linear Integrated Circuits, Fourth Edition By Pearson
7. Operational Amplifiers Theory and Design by Johan Huijsing , Springer
8. Fundamentals of Microprocessor and Microcomputer: B. Ram.
9. Microprocessor Architecture Programming and Application : R.S. Goanker.
10. Introduction to microprocessor : A.P. Mathur.

This course can be opted as an elective by the students of following subjects:

Suggested Continuous Evaluation Methods:

Total Marks: 50

Lab Record File (depending upon the no. of experiments performed out of the total assigned experiments): 20

marks for Viva Voce: 20

Class Interaction: 10

Course prerequisites: To study this course, a student must have basic circuit knowledge.

Suggested equivalent online courses:

https://nptel.ac.in/courses/108108112

M.Sc Electronics Second Year Third Semester

Program/Class: Master of Science in Electronics	Year: Second	Semester: III
Subject: Electronics		
Course Code: B140901T	**Course Title: Communication Theory and Systems**	

Course Objectives:

The purpose of this course is to provide a thorough introduction to analog, digital communications and computer communication with an in-depth study of various modulation techniques. This course also intend to impart students with technical knowledge of Data communication Networks. This Course provides complete understanding of OSI and TCP model along with requisite protocols in all layers.

Course outcomes:

At the end of this course, students will be

1. Able to understand the basic concept of analog communication system and analyze the various amplitude modulation, Frequency and Phase modulation schemes.
2. Able to describe and analyze the various pulse modulation and multiplexing techniques for the digital transmission of analog signal.
3. Able to identify and describe different techniques in modern digital communications.
4. Able to describe and analyze the various pulse modulation and the digital transmission of analog signals.
5. Able to identify and describe different techniques in modern digital communications,
6. Able to understand fundamentals of computer networks, communication protocols, layered network architectures.
7. Able to understand the functionality of CSMA/CD, IP & TCP/UDP and HTTP Protocols.

Credits: 4	Core Compulsory
Max. Marks: 25+75	Min. Passing Marks: 40

Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P: 3-1-0

Unit	Topics	No. of Lectures
I	Communication Process, Source of Information, base-band and pass-band signals, Elements of a Communication System, analog versus digital communication, Need of modulation and typical applications, types of Modulation and demodulation.	15
II	Amplitude modulation with full carrier, suppressed carrier systems, single side band transmission, switching modulators, synchronous detection, envelope detection, comparison of various AM systems, vestigial side band transmission, introduction to angle modulation, Narrow and wide band FM, BW calculations using Carson rule, Direct & Indirect FM generations, phase modulation, Demodulation of FM signals, noise reduction using pre & de-emphasis.	15
III	Pulse Modulation and Digital Modulation: Sampling Theorem and its applications, Concept of Pulse Amplitude Modulation, Pulse width modulation and pulse position modulation, PCM, Signal to quantization ratio in PCM, Delta Modulation, Adaptive delta-modulation Modulation and Demodulation in Digital modulation schemes- Introduction to ASK, FSK, PSK, DPSK, QPSK.	15
IV	Introduction to Computer Communication, Network Basics- Concept, Types, Transmission modes, Topologies, OSI & TCP/IP Models:	15

	Functions of different Layers, concept of MAC, IP (Private/Public) and TCP addresses, Basic Introduction to CSMA/CD, IP & TCP/UDP and HTTP Protocols, Current Internet Applications	

Suggested Readings:

1. H. Taub, D L Schilling, Goutom Saha, "Principles of Communication", 3e, Tata McGraw-Hill Publishing Company Ltd.
2. B.P. Lathi, "Modern Digital and Analog communication Systems", 3e, Oxford University Press,2009.
3. Simon Haykin, "Communication Systems",4e, Wiley India.
4. H. P. HSU & D. Mitra, "Analog and Digital Communications", 2e, Tata McGraw-Hill Publishing Company Ltd.
5. Singh, R.P. &Sapre, S.D. "Communication Systems: Analog & Digital", Tata McGraw-Hill.
6. Behrouz A. Forouzan, Data communication and Networking, Tata McGraw-Hill, India.
7. A.S. Tanenbaum, Computer Networks (2003), 5 ed, Pearson Education/ PHI. New Delhi, India.

This course can be opted as an elective by the students of following subjects

Physics/Computer Science/ Mathematics/Statistics

Suggested Continuous Evaluation Methods:

Total Marks: 25

Internal Test: 10 Marks

Home Assignment/Presentation /Project / Research Orientation/ Term Papers/Seminar: 10 Marks

Class performance/Participation: 5 Marks

Course prerequisites: To study this course, a student must have had the subject Physics/Electronics/Computer Science/ Mathematics/Statistics/Computer Application in class B.Sc.

Suggested equivalent online courses:

1. MIT Open Learning - Massachusetts Institute of Technology, https://openlearning.mit.edu/
2. National Programme on Technology Enhanced Learning (NPTEL), https://www.youtube.com/user/nptelhrd
3. Uttar Pradesh Higher Education Digital Library, http://heecontent.upsdc.gov.in/SearchContent.aspx
8. SwayamPrabha - DTH Channel, https://www.swayamprabha.gov.in/index.php/program

Further Suggestions: ……..

Program/Class: Master of Science in Electronics	**Year: Second**	**Semester: III**
Subject: Electronics		
Course Code: B140902T	**Course Title: Control System**	

Course Objectives:

The basic objective of this course is to provide the students the core knowledge of control systems, in which time & frequency domain analysis, concept of stability.

The purpose of this course is to provide a thorough introduction to analog, digital communications and computer communication with an in-depth study of various modulation techniques. This course also intend to impart students with technical knowledge of Data communication Networks. This Course provides complete understanding of OSI and TCP model along with requisite protocols in all layers.

Course outcomes:

At the end of this course, students will be

1. Able to describe the response, characteristic and differentiate between the open loop and closed

loop of a control system.
2. Able to analyze the transient response of system
3. Determine the response of a control system using poles and zeros to determine the response of a control system
4. Able to understand concept of stability of a control system and analysis of stability using Routh-Hurwitzmeth, Bode Plot, Route Locus and Polar Plot.

Credits:4	**Core: Compulsory**
Max. Marks: 25+75	**Min. Passing Marks:40**

Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P: 3-1-0

Unit	Topics	No. of Lectures
I	Introduction to Control Systems, Basic components of control system, Open-loop and closed-loop systems, Transfer functions of linear systems, block diagrams and its reduction. Signal flow graphs, their properties and gain formula.	**15**
II	Standard test signals, time domain performance of control systems, transient response of the first and second order systems, stability, steady state errors, Error analysis: Static and dynamic error coefficients, Error criterion, Introduction to system optimization effect of adding poles and zeros.	**15**
III	The concept of stability, necessary conditions stability, Routh's stability criterion, relative stability analysis. Root locus technique, construction rules, Correlation between time and frequency responses.	**15**
IV	Stability analysis in frequency domain: Nyquist stability criterion, polar plot, Bode plots, Gain Margin and Phase Margin, P controller, PD controller, PI controller, PID controller.	**15**

Suggested Readings:

1. A J Nagarath and M Gopal, Control System Engineering-, Wiley Eastern, 2nd Edition, 1982.
2. Richard C Dorf, Robert H Bishop, Modern Control Systems, Addison Wesley, 12th Edition, 2010.
3. Ganesh Rao, Control Engineering-, Pearson Education India, 2010
4. K Ogata, Modern Control Engineering, PHI – 2nd Edition, 2010
5. Feedback and Control Systems–Schaum's Outline series McGrawHill
6. Automatic Control Systems- Benjamin C Kuo, PHI, 9thEdition, 2009.
7. Dr. N.K Jain, "Automatic Control System Engineering", Dhanpat Rai Publication, 2005
8. B. C. Kuo, 2001, "Automatic Control system, Prentice Hall of India

This course can be opted as an elective by the students of following subjects

Physics/Computer Science/ Mathematics/Statistics

Suggested Continuous Evaluation Methods:

Total Marks: 25

Internal Test: 10 Marks

Home Assignment/Presentation /Project / Research Orientation/ Term Papers/Seminar: 10 Marks

Class performance/Participation: 5 Marks

Course prerequisites: To study this course, a student must have had the subject Physics/Electronics/Computer Science/ Mathematics/Statistics/Computer Application in class B.Sc.

Suggested equivalent online courses:

1. MIT Open Learning - Massachusetts Institute of Technology, https://openlearning.mit.edu/

2. National Programme on Technology Enhanced Learning (NPTEL), https://www.youtube.com/user/nptelhrd

3. Uttar Pradesh Higher Education Digital Library, http://heecontent.upsdc.gov.in/SearchContent.aspx 8. SwayamPrabha - DTH Channel, https://www.swayamprabha.gov.in/index.php/program
Further Suggestions: ……..

Program/Class: Master of Science Electronics	**Year: Second**	**Semester: III**
Subject: Electronics		
Course Code: B140903T	**Course Title: Power Electronics**	
Course Objectives:		
The course aims to introduce them to the theory of operation, analytical and circuit models and basic design concepts of Electric Power components and systems.		
Course outcomes: At the end of this course, students will be able to **1.** Understand the construction and working of power semiconductor devices 2. Understand and analyze the SCR its turn on methods, turn off methods and protection. 3. Understand the working and construction of DC to AC converters, AC voltage regulator 4. Understand the working & construction of Cycloconverters with different types of loads.		
Credits:4	**Core Compulsory**	
Max. Marks: 25+75	**Min. Passing Marks: 40**	
Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P: 3-1-0		

Unit	**Topics**	**No. of Lectures**
I	Introduction to power electronics: Power semiconductor devices: Power diodes, Power junction FETs: Basic structure and operation. Power MOSFETs: Structure and operation. Power transistors. Thyristor firing circuits: Limitations of di/dt and dv/dt ratings, main features of firing circuits, R and RC firing circuits, UJT firing circuit. Commutation Techniques, series and parallel operation of thyristors.	**16**
II	Controlled rectifiers, Single phase semi, full and dual converters, single phase series converter, power factor improvement, Extinction Angle control, Symmetrical angle control, Pulse width modulation control, Sinusoidal pulse width modulation, Ac voltage controllers, on off and phase control.	**16**
III	DC choppers, step up and step-down operation, classification of choppers, switching mode regulators, single phase Invertors, Switching-mode regulators- buck regulators, boost regulators, buck-boost regulators.	**18**
IV	Cycloconvertors, single and three phase cyclo convertors; Reduction of output harmonics, power supplies, regulated power supply, Switched Mode Power Supply (SMPS). Uninterrupted Power Supply (UPS).	**10**
Suggested Readings: **1.** Power Electronics: Bimbhra P S, Khanna Publishers, 2003. 2. Power Electronics Circuit devices and applications: Rashid M H, PHI.		

3. Thyristor Engineering: Berde, M S Khanna publishers.
4. Power Electronics: Vedam Subrahmanyam, New Age International, 2002.
5. Modern Power Electronics and AC Drives: Bimal K Bose, Pearson Education, 2002.
6. Semiconductor power devices- S K Gandhi, John Wiley, 1977.
7. Power Electronics: Mohan, Undeland, Robbins, John Wiley, 2003.

This course can be opted as an elective by the students of following subjects
Physics/Computer Science/ Mathematics/Statistics

Suggested Continuous Evaluation Methods:
Total Marks: 25
Internal Test: 10 Marks
Home Assignment/Presentation /Project / Research Orientation/ Term Papers/Seminar: 10 Marks
Class performance/Participation: 5 Marks

Course prerequisites: To study this course, a student must have had the subject Physics/Electronics/Computer Science/ Mathematics/Statistics in class of B.Sc**.**

Suggested equivalent online courses:
1. MIT Open Learning - Massachusetts Institute of Technology, https://openlearning.mit.edu/
2. National Programme on Technology Enhanced Learning (NPTEL), https://www.youtube.com/user/nptelhrd
3. Uttar Pradesh Higher Education Digital Library, http://heecontent.upsdc.gov.in/SearchContent.aspx
8. SwayamPrabha - DTH Channel, https://www.swayamprabha.gov.in/index.php/program

Further Suggestions: ……..

Program/Class: Master in Science in Electronics	**Year: Second**	**Semester: III**
Subject: Electronics		
Course Code: B140904T	**Course Title: Analog Integrated Circuits**	

Course Objectives:

The objective of the course is to understand the basic components and methodologies used for Analog Design. Most of the portion deals with OPAMP based circuits and Applications.

Course outcomes:

After completion of this course, a student will be able to:
CO1: Thorough understanding of operational amplifiers
CO2: To design circuits using operational amplifiers for various applications.
CO3: Explain the working and applications of timer, VCO and PLL IC
CO4: Design Oscillators and active filters using Op-Amps.

Credits: 4	**Core: Core Compulsory**
Max. Marks: 25+75	**Min. Passing Marks: 40**

Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P: 3-1-0

Unit	**Topics**	**No. of Lectures**
I	OPERATIONAL AMPLIFIERS: Basic differential amplifier analysis, Single ended and double ended configurations, Op-amp configurations	**15**

	with feedback, Op-amp parameters, and Inverting and Non-Inverting configuration, Comparators, Adder.	
II	OPERATIONAL AMPLIFIER APPLICATIONS: Integrator, Differentiator, Voltage to frequency & Frequency to voltage converters. Oscillators: Phase shift, Wien bridge, Quadrature, square wave, triangular wave, saw tooth oscillators. Voltage controlled oscillators. The 555 timer as astable and monostable multivibrators. Zero crossing detector, Schmitt trigger	**15**
III	ACTIVE FILTERS: Low pass, high pass, band pass and band reject filters, All pass filter, Switched capacitor filter, Butterworth filter design, Chebyshev Filter design.	**15**
IV	PHASE-LOCKED LOOPS: Operating Principles of PLL, Linear Model of PLL, Lock range, Capture range, Applications of PLL as FM detector, FSK demodulator, AM detector, Frequency translator, phase shifter, tracking filter, signal synchronizer and frequency synthesizer, Building blocks of PLL, LM565 PLL , Four quadrant multiplier & its applications, Basic blocks of linear IC voltage regulators	**15**

Suggested Readings:

1. 1. R. A. Gayakwad - Op-amplifiers & Linear ICs, Pearson Education.
2. J.M. Jacob – Applications & Design with Analog Integrated Circuits, Prentice Hall of India.
3. RAMAKALYAN: LINEAR CIRCUITS (Includes CD), Oxford
4. K.R. Botkar – Integrated Circuits, Khanna Publications.
5. Shail and Jain, Linear Integrated Circuit

This course can be opted as an elective by the students of following subjects: M.Sc. Electronics

Suggested Continuous Evaluation Methods:

Total Marks: 25

House Examination/Test: 10 Marks

Written Assignment/Presentation/Project / Research Orientation/ Term Papers/Seminar: 10 Marks

Class performance/Participation: 5 Marks

Course prerequisites: To study this course, a student must have basic circuit knowledge.

Suggested equivalent online courses:

https://onlinecourses.nptel.ac.in/noc22_ee15/preview

Further Suggestions: None

At the End of the whole syllabus any remarks/ suggestions: None

Program/Class: Master in Science in Electronics	**Year: Second**	**Semester: III**
Subject: Electronics		
Course Code: B140905T	**Course Title: Artificial Intelligence and Machine Learning.**	

Course Objectives:

The objective of the course is to understand the basic theory underlying Artificial Intelligence and Machine Learning. It describes to formulate AI & ML problems corresponding to different applications and to understand a range of AI & ML algorithms along with their strengths and weaknesses. This course will make eligible the students to apply AI & ML to solve real-world problems of moderate complexity.

Course outcomes:	
After completion of this course, a student will be able to: CO1: To Understand basics of AI & ML. CO2: Apply basic principles of AI in solutions that require problem solving. CO3: Proficiency in applying scientific method to models of machine learning CO4: Basics of Neural Networks and techniques.	
Credits:4	**Elective**
Max. Marks: 25+75	**Min. Passing Marks: 40**
Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P: 3-1-0	

Unit	Topics	No. of Lectures
I	Introduction: Philosophy of AI, Definitions, Modeling a Problem as Search Problem, Uninformed Search, Heuristic Search, Domain Relaxations, Local Search, Genetic Algorithms, Adversarial Search, Constraint Satisfaction	**15**
II	Propositional Logic & Satisfiability, Uncertainty in AI, Bayesian Networks, Bayesian Networks Learning & Inference, Decision Theory, Markov Decision Processes, Reinforcement Learning, Introduction to Deep Learning & Deep RL	**15**
III	Probability Theory, Linear Algebra, Convex Optimization - (Recap), Introduction: Statistical Decision Theory - Regression, Classification, Bias Variance, Linear Regression, Multivariate Regression, Subset Selection, Shrinkage Methods, Principal Component Regression, Partial Least squares, Linear Classification, Logistic Regression, Linear Discriminant Analysis, Perceptron, Support Vector Machines, Neural Networks - Introduction, Early Models, Perceptron Learning, Back propagation, Initialization, Training & Validation, Parameter Estimation - MLE, MAP, Bayesian Estimation, Decision Trees, Regression Trees, Stopping Criterion & Pruning loss functions, Categorical Attributes, Multi way Splits, Missing Values, Decision Trees - Instability Evaluation Measures, Bootstrapping & Cross Validation, Class Evaluation Measures, ROC curve, MDL, Ensemble Methods - Bagging, Committee Machines and Stacking, Boosting	**15**
IV	Gradient Boosting, Random Forests, Multi-class Classification, Naive Bayes, Bayesian Networks, Undirected Graphical Models, HMM, Variable Elimination, Belief Propagation, Partition Clustering, Hierarchical Clustering, Birch Algorithm, CURE Algorithm, Density-based Clustering, Gaussian Mixture Models, Expectation Maximization, Learning Theory, Introduction to Reinforcement Learning.	**15**

Suggested Readings:

1. Stuart Russell & Peter Norvig, Artificial Intelligence: A Modern Approach, Prentice-Hall, Third Edition (2009) (required).
2. Ian GoodFellow, Yoshua Bengio & Aaron Courville, Deep Learning, MIT Press (2016).

3. The Elements of Statistical Learning, by Trevor Hastie, Robert Tibshirani, Jerome H. Friedman (freely available online)
4. Pattern Recognition and Machine Learning, by Christopher Bishop (optional)

Suggestive digital platforms web links

This course can be opted as an elective by the students of following subjects: M.Sc. Physics

Suggested Continuous Evaluation Methods:

Total Marks: 25
House Examination/Test: 10 Marks
Written Assignment/Presentation/Project / Research Orientation/ Term Papers/Seminar: 10 Marks
Class performance/Participation: 5 Marks

Course prerequisites: To study this course, a student must have known programming. If the students have done introductory courses on probability theory and linear algebra it would be helpful.

Suggested equivalent online courses:

https://onlinecourses.nptel.ac.in/noc21_cs42/preview
https://onlinecourses.nptel.ac.in/noc22_cs29/preview

Further Suggestions: None

At the End of the whole syllabus any remarks/ suggestions: None

Program/Class: Master in Science in Electronics	**Year: Second**	**Semester: III**
Subject: Electronics		
Course Code: B140906T	**Course Title: VHDL Programming**	

Course Objectives:

The objective is to study about to translate a functional system description into appropriate digital blocks coded in VHDL. Perform synthesis, place, and route of a digital design into a target FPGA.

Course outcomes:

After completion of this course, a student will be able to:
CO1: Able to design digital systems through HDL language.
CO2: Simulation, synthesis and implementation of HDL code.
CO3: Implementation of code on FPGA/CPLD.

Credits:4	**Elective**
Max. Marks: 25+75	**Min. Passing Marks: 40**

Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P: 3-1-0

Unit	**Topics**	**No. of Lectures**
I	Introduction to VLSI and HDL History of IC Design, IC Technology, Moore's Law, IC Design Constraints, Feature Size, VLSI Family, Programmable Logic Devices, Designing with Programmable Logic-Design Entry, Simulation, Synthesis, Implementation, Device Programming, EDA Tools, IP Cores, Gjeski's Y Chart. Digital system design process, Hardware simulation, Levels of abstraction, VHDL	**15**

	requirements, Elements of VHDL Top down design, VHDL basic language Elements, VHDL operators, Timing, Concurrency, Objects and classes.	
II	Behavioral Modeling Signal assignments ,Concurrent and sequential assignments., Entity Declaration, Architecture Body, Behavioral Modeling, Process statement, Loop control statements, Multiple Processes, Delay Models, Signal Drivers.	**15**
III	Dataflow and Structural Modeling Techniques Data flow Modeling, Concurrent Assignment statements, Block statements, Structural Modeling, Component declaration and Instantiation, Generate statements.	**15**
IV	Advance Topics in VHDL Generics and Configuration, Subprogram, Overloading, Packages and Libraries, Design Libraries, Attributes. Design for Synthesis Language directed view of synthesis, Inference from CSA statements, Inference from within Process, Inference using Signals v/s variables, Latch v/s Flip Flop Inference, Wait statements, Synthesis Hints, Synthesis for dataflow and structural models.	**15**

Suggested Readings:

1. J. Bhasker, VHDL Primer, 3/e, Addison Wesley, 1999.
2. Sudhakar Yalamanchili, Introductory VHDL-From Simulation to Synthesis, Pearson Education, 3/e Indian Reprint.
3. Douglas Perry, VHDL, 3/e Edition, McGraw Hill 2001.
4. Peter.J.Ashenden, The Designer's Guide to VHDL-AMS,
5. Charles.H.Roth, Digital system Design using VHDL, Thompson Publishers, 2/e Edition, 2007.
6. Ben Cohen, VHDL-Coding style and Methodologies, Kluwer academic Publishers, 1995.
7. Volnei. A.Pedroni, Circuit Design with VHDL, MIT Press Cambridge, 2004.

Suggestive digital platforms web links

This course can be opted as an elective by the students of following subjects: M.Sc. Physics

Suggested Continuous Evaluation Methods:

Total Marks: 25
House Examination/Test: 10 Marks
Written Assignment/Presentation/Project / Research Orientation/ Term Papers/Seminar: 10 Marks
Class performance/Participation: 5 Marks

Course prerequisites: To study this course, a student must have had the basic knowledge of semiconductor devices, digital design and C language.

Suggested equivalent online courses:

https://nptel.ac.in/courses/117108040

Further Suggestions: None

At the End of the whole syllabus any remarks/ suggestions: None

Program/Class: Master of Science in Electronics	Year: Second	Semester: III
Subject: Electronics		
Course Code: B140907P	**Course Title:** Electronics Laboratory Course -III (A)	
Course Objectives:		
The objective of the Laboratory is to provide practical exposure of communication by various technique and applications. The objective of the this Laboratory is also to provide practical exposure of analog integrated circuits and Power Electronics circuits.		
Course outcomes:		
After completion of this course, a student will be able to: CO1: The student will be able to know about various technique of communication. CO2: The student will be able to application of various techniques in different condition. CO3: The student will be able to know about the characteristics of IC741and its applications. CO4: The student will be able to know about the Power Electronics and its applications.		
Credits:5	**Elective**	
Max. Marks: 50+50	**Min. Passing Marks: 40**	
Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P: 0-0-4		

Group	Experiment	No. of Lectures
I	Communication Lab & Elective Experiments: 1. Amplitude modulation and demodulation 2. Frequency modulation and demodulation 3. Pulse Amplitude, Pulse width modulation and Pulse position modulation and demodulation. 4. Delta modulation and demodulation. 5.Experiment based on VHDL/AI and Machine Learning-1 6.Experiment based on VHDL/AI and Machine Learning-2 7.Experiment based on VHDL/AI and Machine Learninh-3 8.Experiment based on VHDL/AI and Machine Learninh-4 9.Experiment based on VHDL/AI and Machine Learninh-1 10. Open ended experiment –A. 11. Open ended experiment –B.	**75**
II	Operational Amplifier and Power Electronics Experiments 1. To determine the following parameter of 741 IC a. Input offset voltage. b. Input offset current. c. Common mode rejection ratio (CMRR). 2. Design adder, Subtractor, Differentiator and Integrator using 741 Operational Amplifier. 3. Design astable and monostable multivibrator using IC555. 4. Study of V-I Characteristics of SCR at different gate currents 5. Study & experimentation of firing angle control of R and R-C firing circuits. 6. Study & firing angle control of UJT firing circuit. 7. Open ended experiment –A. 8. Open ended experiment –B.	**75**

Suggested Readings: 1. Electronic Communication Systems, George Kennedy, Brendan Davis, Srm Prasanna , 2. McGraw Hill Education. 3. 2. Power Electronics: Bimbhra P S, Khanna Publishers, 2003. 4. 3. Power Electronics Circuit devices and applications: Rashid M H, PHI. 5. 4. Thyristor Engineering: Berde, M S Khanna publishers. 6. 5. Power Electronics: Vedam Subrahmanyam, New Age International, 2002. 7. 6. Modern Power Electronics and AC Drives: Bimal K Bose, Pearson Education, 2002.		
This course can be opted as an elective by the students of following subjects:		
Suggested Continuous Evaluation Methods: Total Marks: 50 Lab Record File (depending upon the no. of experiments performed out of the total assigned experiments): 20 marks for Viva Voce: 20 Class Interaction: 10		
Course prerequisites: To study this course, a student must have basic circuit knowledge.		
Suggested equivalent online courses: https://nptel.ac.in/courses/108108112		
Further Suggestions: None		

At the End of the whole syllabus any remarks/ suggestions: None

Program/Class: Master of Science in Electronics	**Year: Second**	**Semester: III**
Subject: Electronics		
Course Code: B140908P	**Course Title:** Electronics Laboratory Course -III (B)	
Course Objectives:		
The objective of the Laboratory is to provide practical exposure of communication by various technique and applications. The objective of the this Laboratory is also to provide practical exposure of analog integrated circuits and Power Electronics circuits.		
Course outcomes:		
After completion of this course, a student will be able to: CO1: The student will be able to know about various technique of communication. CO2: The student will be able to application of various techniques in different condition. CO3: The student will be able to know about the characteristics of IC741and its applications. CO4: The student will be able to know about the Power Electronics and its applications.		
Credits:5	**Core Compulsory**	
Max. Marks: 50+50	**Min. Passing Marks: 40**	
Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P: 0-0-4		

Group	Experiment	No. of Lectures
I	Communication Lab & Elective Experiments: 1. Amplitude and Frequency modulation and demodulation 3. Pulse Amplitude, Pulse width modulation and Pulse position modulation and demodulation. 4. Pulse code modulation and demodulation. 5.Experiment based on VHDL/AI and Machine Learning-1 6.Experiment based on VHDL/AI and Machine Learning-2 7.Experiment based on VHDL/AI and Machine Learninh-3 8.Experiment based on VHDL/AI and Machine Learninh-4 9.Experiment based on VHDL/AI and Machine Learninh-1 10. Open ended experiment –A. 11. Open ended experiment –B.	**75**
II	Operational Amplifier and Power Electronics Experiments 1.Design of differential amplifier. 2.To study the op amp as an adder, subtractor, integrator and differentiator. 3.To design low pass, high pass and band pass filters using op- amp. and plot their frequency response. 4.Design astable and monostable multivibrator using IC555. 5.To design RC phase shift and Wein bridge oscillators using op amplifier. 5.Study of V-I Characteristics of SCR at different gate currents 6.Study & plot of characteristics of diode, thyristor and triac. 7.Study & plot of characteristics of power transistor and MOSFET. 8. Open ended experiment –A. 9. Open ended experiment –B.	**75**

Suggested Readings:

1. Electronic Communication Systems, George Kennedy, Brendan Davis, Srm Prasanna,
2. McGraw Hill Education.
3. 2. Power Electronics: Bimbhra P S, Khanna Publishers, 2003.
4. 3. Power Electronics Circuit devices and applications: Rashid M H, PHI.
5. 4. Thyristor Engineering: Berde, M S Khanna publishers.
6. 5. Power Electronics: Vedam Subrahmanyam, New Age International, 2002.
7. 6. Modern Power Electronics and AC Drives: Bimal K Bose, Pearson Education, 2002.

This course can be opted as an elective by the students of following subjects:

Suggested Continuous Evaluation Methods:

Total Marks: 50
Lab Record File (depending upon the no. of experiments performed out of the total assigned experiments): 20
marks for Viva Voce: 20
Class Interaction: 10

Course prerequisites: To study this course, a student must have basic circuit knowledge.

Suggested equivalent online courses:

https://nptel.ac.in/courses/108108112

Further Suggestions: None

At the End of the whole syllabus any remarks/ suggestions: None

M.Sc Physics (Electronics) Second Year Forth Semester

Program/Class: Master in Science in Electronics	Year: Second	Semester: IV
Subject: Electronics		
Course Code: B141001T	**Course Title: VLSI Design and Technology**	
Course Objectives:		
The objective is to study about a design perspective, starts from basic specifications and ends with system level blocks. The course starts with basic device understanding and then deals with complex VLSI design and circuits keeping in mind the current trend in technology.		
Course outcomes:		
After completion of this course, a student will be able to: CO1: Express the Layout of simple MOS circuit using Lambda based design rules. CO2: Design CMOS based circuit CO3: Understand chip level issues and need of testability. CO4: Concepts of modeling a digital system.		
Credits: 5	**Compulsory Course**	
Max. Marks: 25+75	**Min. Passing Marks: 40**	
Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P: 4-1-0		

Unit	Topics	No. of Lectures
I	MOSFET static behavior, Threshold voltage and its dependence on V_{SB}, MOSFET Operation in resistive and saturation region, Channel length modulation, Velocity saturation and its impact on sub-micron devices, Sub-threshold conduction, Model for manual analysis, Equivalent resistance for MOSFET in (velocity) saturated region, Comparison of equations for PMOS and NMOS, DYNAMIC behavior, Channel capacitance in different regions of operation, junction capacitance.	**18**
II	CMOS Inverter: VTC of CMOS inverter: PMOS and NMOS operation in various regions including velocity saturation, Switching threshold, (W/L)p/(W/L)n ratio for setting desired VM with and without velocity saturation, Noise Margins, buffer, Rationed logic: Pseudo NMOS inverter and PMOS to NMOS ratio for performance, tri-state inverter, Resistive load inverter, Load Capacitance calculations: fan out capacitance, self-capacitance calculations: Miller effect, Propagation delay: first order analysis, analysis from a design perspective, sizing a chain of inverters for minimum delay, choosing optimum number of stages, Power, Energy and Energy Delay: Dynamic power consumption, Static power, Glitches and power dissipation due to direct path currents, power and delay trade off.	**17**
III	CMOS LOGIC: Good 0 and Poor 0, Two and Higher input NAND and NOR, XOR, XNOR gates, Functions implementations, 2 input Multiplexer, Full Adder; Pseudo NMOS, DSVCL logic, CPL based gates, Logical effort, Electrical Effort, Branching effort, Pass-transistor logic, Transmission Gate chain, Dynamic CMOS design: Pre-charge and Evaluation, charge leakage, bootstrapping, charge sharing, DOMINO Logic. NAND and NOR based SR latch, and clocked SR Latch, CMOS D latch, MUX based Latches, clock	**20**

	skew, C2MOS register, TSPCR Register, Schmitt Trigger, Pipelining and NORA CMOS. CMOS Layout design rule.	
IV	Introduction To IC Technology: SSI, MSI, LSI, VLSI Integrated Circuits. Crystal Growth and Wafer Preparation: Electronic Grade Silicon, Czochralski Crystal Growth, Silicon Shaping, Processing Considerations. Wafer Cleaning Technology - Basic Concepts, Wet cleaning, Dry cleaningEpitaxy: Vapor-Phase Epitaxy, Molecular Beam Epitaxy, Silicon on Insulators, Epitaxial Evaluation. Oxidation: Growth Kinetics, Thin Oxides, Oxidation Techniques and Systems, Oxides Properties. Lithography: Optical Lithography, Electron beam lithography, Photo masks, Wet Chemical Etching. Dielectric and Polysilicon Film Deposition: Deposition Processes of Polysilicon, Silicon Dioxide, Silicon Nitride. Diffusion: Models of diffusion in solids, Fick's 1-Dimensional diffusion equation, Diffusion of Impurities in Silicon and Silicon Dioxide, Diffusion Equations, Diffusion Profiles, Diffusion Furnace, Solid, Liquid and Gaseous Sources, Ion-Implantation: Ion-Implantation Technique, Range Theory, Implantation Equipment. Metallization: Metallization Application, Metallization Choices, Physical Vapor Deposition, Vacuum Deposition, Sputtering Apparatus. Packaging of VLSI devices: Package Types, Packaging Design Consideration, VLSI Assembly Technologies, Package Fabrication Technologies, CMOS fabrication steps.	**20**

Suggested Readings:

1. Kang: CMOS Digital ICs, McGraw-Hill Science/Engineering/Math; 3 edition
2. Jan M Rabaey: Digital Integrated Circuits, Prentice Hall; 2 edition (January 3, 2003).
3. Neil H.E. Weste and Kamran Eshraghian, Principles of CMOS VLSI Design, Pearson Education ASIA, 2nd edition, 2000.
4. John P.Uyemura "Introduction to VLSI Circuits and Systems", John Wiley & Sons, Inc.,
5. Eugene D.Fabricius, Introduction to VLSI Design McGraw Hill International Editions
6. Pucknell, "Basic VLSI Design", Prentice Hall of India Publication, 1995.
7. S. M. Sze, "VLSI Technology", McGraw Hill Publication, 2003
8. S.K. Ghandhi, "VLSI Fabrication Principles", Willy-India Pvt. Ltd, 2008

This course can be opted as an elective by the students of following subjects: M.Sc. Electronics

Suggested Continuous Evaluation Methods:

Total Marks: 25

House Examination/Test: 10 Marks

Written Assignment/Presentation/Project / Research Orientation/ Term Papers/Seminar: 10 Marks

Class performance/Participation: 5 Marks

Course prerequisites: To study this course, a student must have had the basic knowledge of semiconductor devices and digital design.

Suggested equivalent online courses:

https://onlinecourses.nptel.ac.in/noc21_ee09/preview

https://www.coursera.org/certificates/vlsi-design-iitr

Further Suggestions: None

At the End of the whole syllabus any remarks/ suggestions: None

Program/Class: Master of Science in Electronics	Year: Second	Semester: IV
Subject: Electronics		
Course Code: B141002T	**Course Title: Digital Signal Processing**	

Course Objectives

The objective of the Digital signal processing course is to provide the student with significant skills in general as well as advanced theories and methods for modification, analysis, detection and classification of analog and digital signals. Furthermore, the objective is to give the student a broad knowledge of central issues regarding design, realisation and test of analog and in particular digital signal processing systems consisting of hardware and/or software components.

Course outcomes:

At the end of this course, students will be able to

1. Attain significant skills in general as well as advanced theories and methods for modification, analysis, detection and classification of analog and digital signals.

2. Understand a broad knowledge regarding design, realization and test of analog and in particular digital signal processing systems consisting of hardware and/or software components.

3. Able to develop DSP algorithms for convolution, correlation, DFT, filtering of signals etc.

4. Understand the Design and realize various digital filters for digital signal processing.

Credits: 5	Core Compulsory
Max. Marks: 25+75	**Min. Passing Marks: 40**

Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P: 4-1-0

Unit	Topics	No. of Lectures
I	Introduction to Digital Signal Processing, Analog Signal Processing vs Digital Signal Processing, Basic Elements of Digital Signal Processing, Applications of DSP, Discrete time signals and its sequences, representation of signals. discrete time, LTI systems, impulse response, casual and stable system, linear constant coefficient equation, structure of discrete time system	18
II	Z – Transform: Definition, region of convergence, property of z – transform, inverse z – transform, application of Z-Transform for the analysis of discrete time LTI systems, Transfer function of discrete time systems, Significance of poles and zero.	17
III	Discrete Time Fourier Transform (DTFT) and their properties, Discrete Fourier Transform (DFT) and their properties, DFT as a linear transformation, Inverse Discrete Fourier transform, Fast Fourier Transform (FFT) algorithm using Decimation in Time & Decimation in Frequency	20
IV	Structures of IIR system, design of Discrete time IIR filter from analog filter – IIR filter design by Impulse Invariance, Bilinear transformation, Design of FIR Digital filters: Window method, Park-McClellan's method, Effect of finite register length in FIR filter design, comparison of FIR and IIR Filter.	20

Suggested Readings:

1. Prokis, Manolakis. Digital signal processing
2. Oppenheim & Schaffer; Digital Signal Processing
3. Fafael C. Gonzalez, Richrd E. Woods; Digital Image Processing
4. Anil Kumar Jain; Fundamentals of Digital Image Processing

5. S.K.Mitra; Digital Signal Processing
6. S. Salivahanan, A. Vallavaraj, Digital Signal Processing, Tata McGraw-Hill Education

This course can be opted as an elective by the students of following subjects

Physics/Computer Science/ Mathematics/Statistics

Suggested Continuous Evaluation Methods:

Total Marks: 25

Internal Test: 10 Marks

Home Assignment/Presentation /Project / Research Orientation/ Term Papers/Seminar: 10 Marks

Class performance/Participation: 5 Marks

Course prerequisites: To study this course, a student must have had the subject Physics/Electronics/Computer Science/ Mathematics/Statistics in class B.Sc.

Suggested equivalent online courses:

1. MIT Open Learning - Massachusetts Institute of Technology, https://openlearning.mit.edu/

2. National Programme on Technology Enhanced Learning (NPTEL), https://www.youtube.com/user/nptelhrd

3. Uttar Pradesh Higher Education Digital Library, http://heecontent.upsdc.gov.in/SearchContent.aspx

8. SwayamPrabha - DTH Channel, https://www.swayamprabha.gov.in/index.php/program

Further Suggestions: ……..

Program/Class: Master of Science in Electronics	**Year: Second**	**Semester: IV**
Subject: Electronics		
Course Code: B141003T	**Course Title: Optoelectronics and Optical Communication**	

Course Objectives

The objective of this course is to introduce the student to the Optical sources, detectors understanding of basics of fiber optical communication. This includes the properties of optical fibers and how are they used to establish optical links for communication systems.

Course outcomes:

At the end of this course, students will be able to

1. Understand fundamental properties of light and operation principles of basic optical Components.
2. Understand the operating principles and characteristics of optical sources.
3. Understand and compare operating principles, characteristics of optical detectors.
4. Understand fundamentals theories, basic principles and components of optical fiber communication system.

Credits: 5	**Elective Course**
Max. Marks: 25+75	**Min. Passing Marks: 40**

Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P: 4-1-0

Unit	**Topics**	**No. of Lectures**
I	Light Emitting Diodes (LEDs): Structures, light source materials, Quantum Efficiency on LED Power Modulation of a LED, Lasers, Theory of Stimulated emission, Principle of laser action, types of lasers, Laser diodes, characteristics of semiconductor lasers and LEDs.	18

II	Optical detector principle, Characteristics of photo detector-absorption coefficient, detector, characteristics, Quantum efficiency, responsivity, P-N junction-photo diode, P-I-N photodiode, avalanche photodiode, Noise in Photo detectors, Photo conductors.	18
III	Different generations of optical fiber communication systems, Optical fiber structure, Propagation of light- total internal reflection, acceptance angle and numerical aperture, Step-index, Graded-index, Single and Multimode fibers.	20
IV	Transmission characteristics of optical fibers-Signal degradation in optical fibers; Attenuation, Dispersion and pulse broadening in different types of optical fibers, fiber splicing, fiber connectors, connection losses, fiber couplers.	19

Suggested Readings:

1. John M.Senior, Optical fiber Communications; Principles and practice by, 3rd Edition, 2010, Pearson education.
2. Gerd Keiser, Optical Fiber Communication; 5th Edition, 2013, Tata McGraw Hills.
3. Djafar K Mynbaev & Lowell L Scheiner; Fiber Optic Communications Technology by, 3rd Edition, 2008, Pearson Education.
4. J. Gowar, Optical Communication systems, 2nd Edition, 2001, Prentice-Hall of India.
5. Govind P. Agrawal; Fiber-Optic Communication Systems by, 3rd Edition, 2007, Wiley India.
6. Ghatak and Thyagrajan, Optical Electronics, Cambridge University Press

This course can be opted as an elective by the students of following subjects

Physics/Computer Science/ Mathematics/Statistics

Suggested Continuous Evaluation Methods:

Total Marks: 25

Internal Test: 10 Marks

Home Assignment/Presentation /Project / Research Orientation/ Term Papers/Seminar: 10 Marks

Class performance/Participation: 5 Marks

Course prerequisites: To study this course, a student must have had the subject Physics/Electronics/Computer Science/ Mathematics/Statistics in class certificate/diploma.

Suggested equivalent online courses:

1. MIT Open Learning - Massachusetts Institute of Technology, https://openlearning.mit.edu/
2. National Programme on Technology Enhanced Learning (NPTEL), https://www.youtube.com/user/nptelhrd
3. Uttar Pradesh Higher Education Digital Library, http://heecontent.upsdc.gov.in/SearchContent.aspx
8. SwayamPrabha - DTH Channel, https://www.swayamprabha.gov.in/index.php/program

Further Suggestions: ……..

Program/Class: Master of Science in Electronics	Year: Second	Semester: IV
Subject: Electronics		
Course Code: B141004T	**Course Title: Radar Satellite Communication and Remote Sensing**	

Course Objectives

This course builds basic knowledge of different types of Radar systems and satellite communication along with link designing & application. It also covers different modulation schemes & channels used.

Course outcomes:

At the end of this course, students will be able to

1. Revised the fundamentals of orbital mechanics, identify the characteristics of common orbits used by communications and other satellites.

2. Identify the Different elements used to design the earth station for satellite communication.

3. Identify the Different elements used to design the space station for satellite communication.

Credits: 5	Elective Course
Max. Marks: 25+75	Min. Passing Marks: 40

Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P: 4-1-0

Unit	Topics	No. of Lectures
I	Basic Pulsed radar system, Display devices, MTI radar, CW radar, FMCW radar, radar altimeter.	17
II	Principle of satellite communication, general and technical characteristics, Active and passive satellite, Modem and codec, general link design equation, atmospheric and ionospheric effect on link design, earth station parameters.	20
III	Satellite orbital mechanism, Placement of satellite in geostationary orbit Control, telemetry, tracking and command.	17
IV	Remote sensing, concept and foundation of remote sensing, Electromagnetic radiation (EMR), interaction of EMR with atmosphere and earth surface, Application area of remote sensing, Ground, air and space platforms, Return beam vidicon, multispectral scanners, brief description of landsat and IRS satellite.	20

Suggested Readings:

1. Dennis Roddy, 'Satellite Communication', McGraw Hill International, 4 th Edition, 2006
2. Timothy Pratt, Charles Bostian, Jeremy Allnutt, Satellite Communication' by, Willey Student edition, second edition.
3. M.I.Skolnik,Introduction to Radar System, McGraw Hill
4. Sen & Bhattacharya, Radar Systems and Radio Aids to Navigation, Khanna publishers.
5. D C Agarwaland, Satellite Communications
6. Prats and Bostian, Satellite Communication-
7. J.B. Campbell, Introduction to remote sensing-
8. R N Colwall, Manual ofremote sensing, Vol. I & II-, American Society of Photogrammetry

This course can be opted as an elective by the students of following subjects

Physics/Computer Science/ Mathematics/Statistics

Suggested Continuous Evaluation Methods:

Total Marks: 25 Internal Test: 10 Marks Home Assignment/Presentation /Project / Research Orientation/ Term Papers/Seminar: 10 Marks Class performance/Participation: 5 Marks
Course prerequisites: To study this course, a student must have had the subject Physics/Electronics/Computer Science/ Mathematics/Statistics in class B.Sc.
Suggested equivalent online courses: **1.** MIT Open Learning - Massachusetts Institute of Technology, https://openlearning.mit.edu/ 2. National Programme on Technology Enhanced Learning (NPTEL), https://www.youtube.com/user/nptelhrd 3. Uttar Pradesh Higher Education Digital Library, http://heecontent.upsdc.gov.in/SearchContent.aspx 8. SwayamPrabha - DTH Channel, https://www.swayamprabha.gov.in/index.php/program
Further Suggestions: ……..

Program/Class: Master of Science in Electronics	**Year: Second**	**Semester: IV**
Subject: Electronics		
Course Code: B141005P	**Course Title:** Major Research Project/Dissertation	
Course Objectives:		
The objective of this course is to apprise the student with various techniques and areas of modern-day research in Emerging areas of Electronics.		
Course outcomes:		
After completion of the course, a student will be able to: CO 1:Prepare synopsis of a defined research problem. CO 2:Perform the bench work. CO 3: Prepare the research report and its oral presentations. CO4:Get exposure of vigorous laboratory training which will help students to boost their research carrier.		
Credits: 10	**Core Compulsory**	
Max. Marks: 50+50	**Min. Passing Marks:40**	
Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P: 0-0-20		
Suggested Continuous Evaluation Methods: **(Assessment is done by Guide)** Total Marks: 50 Content of Report: 20 Continuous Assessment by Guide: 20 Interaction with Guide: 10		