M.D. UNIVERSITY, ROHTAK

SCHEME OF STUDIES AND EXAMINATION

B.TECH (Minor in Electronics and Communication)

(For branches other than Electronics and Communication Engineering)

Scheme effective from 2026-27

COURSE CODE AND DEFINITIONS

Course Code	Definitions
L	Lecture
P	Practical
LC	Laboratory Courses
PCC	Program Compulsory Course.
PEC	Program Elective Course
OE	Open Elective

NOTE: The minor has to be a subject offered by a department other than the department that offers the major of the student or it can be a different major offered by the same department. For example, a student with the declared major in Mechanical Engineering may opt to do a minor in ECE; in which case, the student shall receive the degree B.Tech, Mechanical Engineering with a minor in ECE. A student can do Majors in chosen filed as per the career goal, and a minor may be chosen to enhance the major thus adding the diversity, breadth and enhanced skills in the field.

Advantages of Minor in Engineering:

The minors mentioned above are having lots of advantages and a few are listed below:

- **To apply the inter-disciplinary knowledge gained through a Major (Stream) + Minor.**
- **To enable students to pursue allied academic interest in contemporary areas.**
- **To provide an academic mechanism for fulfilling multidisciplinary demands of industries.**
- **To provide effective yet flexible options for students to achieve basic to intermediate level competence in the Minor area.**
- **Provides an opportunity to students to become entrepreneurs and leaders by taking business/management minor.**
- **Combination in the diverse fields of engineering e.g., CSE (Major) + Electronics (Minor) combination increases placement prospects in chip designing companies.**
- **Provides an opportunity to Applicants to pursue higher studies in an inter-disciplinary field of study.**
- **Provides opportunity to the Applicants to pursue interdisciplinary research.**
- **To increase the overall scope of the undergraduate degrees.**

MAHARSHI DAYANAND UNIVERSITY, ROHTAK

SCHEME OF STUDIES & EXAMINATIONS
B.TECH (Minor in Electronics and Communication Engineering)
(For branches other than Electronics and Communication Engineering)

w.e.f. 2026-2027

S. No.	Semester	Course Code	Course Title	Teaching Schedule			Marks of Class work	Examination Marks		Total	Credit	Duration of Exam
				L	T	P		Theory	Practical			
1	3rd Sem	26ECEOM-201-H	Analog Circuits	3	0	0	25	50	-	75	3	3
2	3rd Sem	26ECEOM-203-H	Analog Circuits Lab	0	0	2	5		20	25	1	3
3	4th Sem	26ECEOM-202-H	Digital Signal Processing	3	0	-	25	50	-	75	3	3
4.	4thSem	26ECEOM-204-H	Digital Signal Processing Lab	0	0	2	5		20	25	1	3
5.	5th Sem	27ECEOM-301-H	Computer Network	3	0	0	25	50	-	75	3	3
6.	5th Sem	27ECEOM-303-H	Computer Network Lab	0	0	2	5		20	25	1	3
7	6thSem	27ECEOM-302-H	Microprocessors and Interfacing	3	0	0	25	50	-	75	3	3
8.	6thSem	27ECEOM-304-H	Microprocessors and Interfacing Lab	0	0	2	5	-	20	25	1	3
9.	7thSem	28ECEOM-401-H	Antenna and Wave Propagation	3	0	0	25	50	-	75	3	3
10.	7thSem	28ECEOM-403-H	Project	0	0	2	5	-	20	25	1	3
		Total								500	20	

Course code	26ECEOM-201-H				
Category	Minor Degree Course				
Course title	**Analog Circuits**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester-III**
	3	0	0	3	
Classwork	25 Marks				
Examination	50 Marks				
Total	75 Marks				
Duration of Exam	03 Hours				

Note: The examiner will set a total of 9 questions. Question one will carry questions from all units, and the remaining eight questions will be set by taking two questions from each unit. The students have to attempt five questions in total, with the first being compulsory and selecting one from each unit. All questions will carry equal marks.

Course Objectives:

1. **Understand** the high-frequency models of transistors and analyze the frequency response of single-stage and multistage amplifiers, including cascode configurations.
2. **Explain and evaluate** different classes of power amplifier operation (Class A, B, AB, C) in terms of efficiency, linearity, and practical applications.
3. **Apply feedback theory** to electronic amplifiers and analyze the effect of feedback on gain, bandwidth, and stability.
4. **Design and analyze** oscillators, and differential amplifiers for specified performance requirements.

COURSE OUTCOMES (CO):

By the end of the Course, Students will be able to:

CO1: Understand high-frequency transistor models and analyze frequency response of single-stage and multistage amplifiers including cascode configuration.

CO2: Analyze different classes of operation of power amplifiers and evaluate their efficiency and linearity.

CO3: Apply feedback theory to amplifier circuits and analyze stability parameters

CO4: Design and analyze oscillators, and differential amplifier circuits.

CO - PO mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PSO1	PSO2	PSO3
CO1	3	3	2	2	2	-	-	-	-	-	2	3	2	1
CO2	3	3	2	1	1	-	-	-	-	-	2	3	2	1
CO3	3	3	3	2	2	-	-	-	-	-	2	3	3	1
CO4	3	3	3	2	2	-	-	-	-	-	2	3	3	2
WT. AVG	3	3	2.5	1.75	1.75						2	3	2.5	1.25
Overall Mapping of Subject														2.25

UNIT I

Amplifier models: Amplifier models: Voltage amplifier, current amplifier, trans-conductance amplifier and trans-resistance amplifier. Small signal analysis of BJT, low frequency transistor models, estimation of voltage gain, input resistance, output resistance etc., design procedure for particular specifications, low frequency analysis of multistage amplifiers. High frequency transistor models, frequency response of single stage and multistage amplifiers, cascode amplifier.

UNIT II

Feedback Amplifiers: Feedback concept, Transfer Gain with Feedback, General Characteristics of Negative Feedback, Advantages & disadvantages, Input And Output Resistance, Voltage Series Feedback topology, Voltage Shunt, Current Series & Current Shunt topology ,Equivalent circuit for each topology, Effects of Negative Feedback.

Oscillators: Introduction, Barkhausen Criterion, Oscillator with RC Feedback circuit (RC Phase Shift, Wien Bridge), Tuned Collector, Tuned Base Oscillator, LC Feedback circuits (Hartley, Colpitts), Condition for Sustained Oscillations & Frequency of Oscillations, Crystal Oscillator.

UNIT III

Power Amplifier: Definition, Application & Types of Power Amplifiers, Amplifier Classes of Efficiency (Class - A, B, AB, C), Push Pull Amplifiers, Distortion in Simple & Push Pull Amplifier, Complementary Push Pull Amplifier,

Operational Amplifier Fundamentals:Block Diagram Representation, Ideal OP-AMP, OP-AMP Equivalent Circuit, characteristics, Differential amplifier: Basic structure and principle of operation, calculation of differential gain, common mode gain, CMRR and ICMR.

UNIT IV

OP-AMP applications: review of inverting and non-inverting amplifiers, integrator and differentiator, summing amplifier, precision rectifier, Schmitt trigger and its applications. Active filters: Low pass, high pass, band pass and band stop, design guidelines. Digital-to-analog converters (DAC): Weighted resistor, R-2R ladder, resistor string etc. Analog-to-digital converters (ADC): Single slope, dual slope, successive approximation, flash etc.:
555 timer: operation as astable and monostable multivibrator.

Alternative NPTEL/SWAYAM Course:

S. No.	NPTEL Course Name	Instructor	Host Institute
1	Analog Electronics Circuits	Prof.Pradip Mandal	IIT Kharagpur
2	Analog Electronics Circuits	Prof.ShanthiPavan	IITMadras

Text/ Reference Books

1. A.V.N. Tilak, Design of Analog Circuits, Khanna Publishing House, 2022.

2. J.V. Wait, L.P. Huelsman and GA Korn, Introduction to Operational Amplifier theory and applications, McGraw Hill, 1992.

3. P. Horowitz and W. Hill, The Art of Electronics, 2nd edition, Cambridge University Press, 1989.

4. A.S. Sedra and K.C. Smith, Microelectronic Circuits, Saunder's College Publishing, Edition IV

5. Paul R.Gray& Robert G.Meyer, Analysis and Design of Analog Integrated Circuits, John Wiley, 3rd Edition

Course code	26ECEOM-203-H				
Category	Minor Degree Course				
Course title	**Analog circuits Lab**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester-III**
	0	**0**	**2**	**1**	
Internal Lab	05 Marks				
External lab	20 Marks				
Total	25 Marks				
Duration of Exam	03 Hours				

Course Objective

1. **Understand and verify** the practical behavior of analog electronic circuits such as amplifiers, oscillators, and feedback systems.
2. **Analyze**the frequency response, gain, and stability of single-stage and multistage amplifiers through experimental methods.
3. **Design and implement** OP-AMP based circuits including integrator, differentiator, and Schmitt trigger, and verify their characteristics.
4. **Construct and test** oscillator circuits (RC phase shift and Wien Bridge) and study the conditions for sustained oscillations.

Course Outcomes

CO1: Apply theoretical concepts to analyze frequency response of amplifiers using experimental/simulation tools.

CO2: Evaluate the effect of different feedback topologies on amplifier performance parameters.

CO3: Design and verify sinusoidal oscillators (RC and Wien bridge) and analyze their working principles.

CO4: Design and implement OP-AMP based applications such as integrator, differentiator, and Schmitt trigger.

CO - PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PSO1	PSO2	PSO3
CO1	3	3	2	3	2	-	-	-	-	-	2	3	2	1
CO2	3	3	2	3	2	1	-	-	-	-	2	3	2	1
CO3	3	3	3	3	2	1	-	-	-	-	2	3	3	1
CO4	3	3	3	3	2	1	-	-	-	-	2	3	3	1
WT. AVG	3	3	2.5	3	2	1					2	3	2.5	1
Overall Mapping of Subject														2.16

List of experiments:

1. To analyze and study frequency response of single and multistage amplifier.
2 To analyze and study different types of feedback topology.

3. To analyze and study RC phase shift oscillator.

4 .To analyze and study wein bridge oscillator.

5. To analyze and study the op-amp as an Integrator.

6. To analyze and study the op-amp as a differentiator.

7. To analyze and study CE amplifier and calculate its gain.

8. To analyze and study 555 timer as a square wave generator.

9. To design Schmitt trigger using Op-amp and verify its operational characteristics

10. To analyze and study working of Push-Pull amplifier.

11. To design and study astablemultivibrator using 555 timer.

12. To design and study monostablemultivibrator using 555 timer.

Reference Books:

1. Millman&Halkias: Integrated Electronics, TMH.
2. Boylestad&Nashelsky: Electronic Devices & Circuit Theory, PHI.
3. A.S. Sedra and K.C. Smith, Microelectronic Circuits, Saunder's College Publishing, Edition IV

Note: Atleast eight (8) experiments from the above list are mandatory to perform for the students

EXPERIMENTS THAT MAY BE PERFORMED THROUGH VIRTUAL LABS:

ONLINE LINK FOR EXPERIMENT:

1. https://iitb.vlabs.co.in/discipline.html?discipline=Electronics_%26_Communications&utm_source=chatgpt.com
2. https://iitb.vlabs.co.in/

Course code	26ECEOM-202-H				
Category	Minor Degree Course				
Course title	**Digital Signal Processing**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester-IV**
	3	**0**	**0**	3	
Internal Lab	25 Marks				
External lab	50 Marks				
Total	75 Marks				
Duration of Exam	03 Hours				

Note: The examiner will set a total of 9 questions. Question one will carry questions from all units, and the remaining eight questions will be set by taking two questions from each unit. The students have to attempt five questions in total, with the first being compulsory and selecting one from each unit. All questions will carry equal marks.

Course Objectives:

CO1: Develop a fundamental understanding of discrete-time signals and systems, sampling theory, Z-transform, and their applications in the analysis and characterization of digital systems.
CO2: Analyze signals and systems in the frequency domain using the Discrete Fourier Transform (DFT), Fast Fourier Transform (FFT), and convolution techniques for efficient digital signal processing.
CO3: Design and evaluate FIR and IIR digital filters using classical design techniques, including window methods, frequency sampling, bilinear transformation, impulse invariance, and standard approximation methods such as Butterworth, Chebyshev, and Elliptic filters.
CO4: Implement discrete-time systems using various realization structures, analyze finite word-length effects, apply spectral estimation techniques, and explore practical applications of Digital Signal Processing in engineering systems.

Course Outcomes: At the end of the Course, the student will have the ability to:

CO1	Analysis of Discrete Time system using Z transforms systems
CO2	Computation procedures for DFT using FFT algorithms
CO3	Analysis and design of FIR and IIR filters
CO4	Realization of FIR and IIR structures

Mapping of Course Outcomes to Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	-	-	-	1	1	-	2	-	-	2	-	3	2
CO2	3	3	-	-	-	1	1	-	2	-	-	2	-	3	2
CO3	3	3	3	-	-	-	1	3	-	-	-	2	-	3	2
CO4	3	3	2	-	-	-	1	-	2	-	-	2	-	3	2

UNIT I

Discrete-Time Signals and Systems: Sequences; representation of signals on orthogonal basis; representation of discrete systems using difference equations, Sampling and reconstruction of signals - aliasing; Sampling theorem and Nyquist rate.

Z-Transform: Z-Transform, Region of Convergence, Analysis of Linear Shift Invariant systems using z- transforms, Properties of z-transform for causal signals, Interpretation of stability in z-domain, Inverse z-transforms.

UNIT 2

Frequency Representation of Signal and Systems: Frequency Domain analysis concept, Discrete Fourier Transform (DFT), Properties of DFT, Convolution of signals, Circular convolution, Linear Filtering using DFT, Fast Fourier Transform Algorithm, Decimation in time and Decimation in frequency algorithms, Computations Complexity Calculations, Parsevals Identity.

UNIT 3

Design of Digital Filter: Ideal Filter vs Practical Filters, General Specifications and Design Steps, Comparison of FIR & IIR Filters, Design of FIR Filters using Window technique, Frequency sampling Method, Park-McClellan's method, Design of IIR Filters using Impulse Invariance technique, Bilinear Transformation, Design of IIR Filters using Butterworth, Chebyshev and Elliptic filter, Digital frequency transformation.

UNIT 4

Implementation of Discrete Time Systems: Block diagrams and signal flow graphs for FIR and IIR systems, Direct form, Cascade form, Frequency Sampling Structures, and Lattice structures for FIR systems, Direct form, Cascade form, Parallel form, and Lattice and Lattice-Ladder Structures for IIR systems, Representation of fixed point and floating point numbers, Finite word length effects, Parametric and non-parametric spectral estimation. Applications of Digital Signal Processing

Multirate Digital Signal Processing: Introduction to multirate digital signal processing, Multi rate structures for sampling rate conversion, Multistage decimator and interpolators, Polyphase decomposition, Digital Filter Banks

References :

1John G. Proakis and D.G. Manolakis, Digital Signal Processing: Principles, Algorithms And Applications, Prentice Hall, latest edition

1. A.V. Oppenheim and Schafer, Discrete Time Signal Processing, Prentice Hall, latest edition
3. S.K.Mitra, Digital Signal Processing: A computer based approach.TMH
4. Digital Signal Processing: Salivahanan, Vallavaraj and Gnanapriya;TMH
5. L.R. Rabiner and B. Gold, Theory and Application of Digital Signal Processing, Prentice Hall, latest edition
6. J.R. Johnson, Introduction to Digital Signal Processing, Prentice Hall, latest edition
7. D.J.DeFatta, J. G. Lucas andW.S.Hodgkiss, Digital Signal Processing, John Wiley& Sons, latest edition

Course code	26ECEOM-204-H				
Category	Minor Degree Course				
Course title	**Digital Signal Processing Lab**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester-IV**
	0	**0**	**2**	**1**	
Internal Lab	05 Marks				
External lab	20 Marks				
Total	25 Marks				
Duration of Exam	03 Hours				

Note : A minimum of eight experiments to be performed by the student.

Course Objectives:

CO1: Develop proficiency in generating and analyzing basic discrete-time signals and implementing fundamental DSP operations such as Z-transform, convolution, correlation, DFT, IDFT, FFT, and circular convolution using programming tools.
CO2: Apply digital signal processing techniques to sampling rate conversion, including interpolation and decimation, and analyze their impact on discrete-time signals.
CO3: Design and implement analog, IIR, and FIR digital filters using standard design techniques and evaluate their frequency-domain characteristics for different filter specifications.
CO4: Analyze the effects of noise on signals and apply DSP algorithms for signal detection and processing in practical engineering applications using simulation tools.

Course Outcomes: At the end of the Course, the student will have the ability to:

CO1	Experiment concepts of Digital Signal processing and its applications using MATLAB.
CO2	Familiarize with the convolution and correlation operations.
CO3	Familiarize with the DFT and FFT operations.
CO4	Design Analog and Digital Filters.

Mapping of Course Outcomes to Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	-	3	2	-	-	-	2	-	-	1	-	2	3
CO2	3	3	-	3	2	-	-	-	2	-	-	1	-	2	3
CO3	3	3	-	3	2	-	-	-	2	-	-	1	-	2	3
CO4	3	3	-	3	2	-	-	-	2	-	-	1	-	2	3

1. Represent basic signals (unit step, unit impulse, ramp, exponential, sine and cosine)
2. To develop program for Z-Transform
3. To develop program for Convolution of sequences
4. To develop program for Correlation of sequences
5. To develop program for DFT & IDFT of two sequences

6. To develop program for FFT of two Sequences
7. To develop program for Circular Convolution
8. To design analog filters (low-pass, high pass, band-pass, band-stop).
9. To design digital IIR filters (low-pass, high pass, band-pass, band-stop).
10. To develop program for Interpolation and Decimation of sequences
11. To design FIR filters using windows technique.
12. Detection of Signals buried in Noise Effect of noise on signals

Course code	27ECEOM-301-H				
Category	Minor Degree Course				
Course title	COMPUTER NETWORK				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester-V**
	3	**0**	**0**	**3**	
Internal Lab	25 Marks				
External lab	50 Marks				
Total	75 Marks				
Duration of Exam	03 Hours				

Note: The examiner will set a total of 9 questions. Question one will carry questions from all units, and the remaining eight questions will be set by taking two questions from each unit. The students have to attempt five questions in total, with the first being compulsory and selecting one from each unit. All questions will carry equal marks.

Course Objectives:

CO1: Develop a comprehensive understanding of computer network architectures, protocol layering, network hardware, transmission media, switching techniques, and the functions of the physical layer.
CO2: Analyze data link layer protocols, media access control mechanisms, error control techniques, wired and wireless LAN technologies, and multiplexing methods for reliable data communication.
CO3: Understand the functions of the network layer, including IPv4 and IPv6 addressing, routing protocols, subnetting, congestion control, quality of service (QoS), and Internet control protocols.
CO4: Explain the services and protocols of the transport and application layers, including TCP, UDP, HTTP, FTP, DNS, Telnet, SSH, electronic mail, SNMP, and their roles in end-to-end communication and network applications.

Course Outcomes:

CO1	Visualise the different aspects of networks, protocols and network design models.
CO2	Examine various Data Link layer design issues and Data Link protocols.
CO3	Analyse and compare different LAN protocols.
CO4	Compare and select appropriate routing algorithms for a network.

CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	-	-	-	-	2	-	1	3	-	-	3	2	-	3
CO2	2	1	3	2	2	-	-	-	-	2	2	3	2	-	3
CO3	2	-	-	3		-	-	-	2	-	-	-	3	-	3
CO4	2	2	-	-	3	-	2	-	-	-	3	2	2	-	2

UNIT I

Introduction and Physical Layer Networks – Network Types LAN –MAN – WAN – Protocol Layering – OSI Model - TCP/IP Protocol suite – Network Hardware, Internetworks – Network Software – Protocol hierarchies –– Physical Layer: Performance – Transmission media – Switching – Circuit switched Networks – Packet Switching.

UNIT II

Data-Link Layer & Media Access Introduction – Link-Layer Addressing – DLC Services – Data-Link Layer Protocols – HDLC – ALOHA protocols - Overview of IEEE standards – Media Access Control – Sliding Window protocols, Error Handling - Bridges - Switches – High Speed LANs - Gigabit Ethernet - Wired LANs: Ethernet – Wireless LANs – Introduction – IEEE 802.11, Bluetooth – Connecting Devices - Multiplexing.

UNIT III

Network Layer Network Layer Services –Performance – IPV4 Addresses –Network Layer Protocols: IP, Internet Control Protocols – ICMP, ARP, RARP, BOOTP. Internet Multicasting – IGMP ICMP v4 – IP Addressing – Classless and Classfull Addressing - Sub-netting - Congestion control– QoS.- Overview of IPv6

UNIT IV

Transport Layer and Application Layer Introduction – Transport Layer Protocols – Services – Port Numbers – User Datagram Protocol – Transmission Control Protocol –Connectionless transport - Remote Procedure Call. vs Connection-oriented WWW and HTTP – FTP –Telnet – SSH – DNS –Electronic mail, MIME, SNMP.

References: 1. J.F. Kurose and K. W. Ross, " Computer Networking – A top down approach featuring the Internet" , Pearson Education, latest edition
2. L. Peterson and B. Davie, " Computer Networks – A Systems Approach" Elsevier Morgan Kaufmann Publisher, latest edition
3. T. Viswanathan, " Telecommunication Switching System and Networks" , Prentice Hall
4. B. A. Forouzan, "Data Communications and Networking", Tata McGraw Hill, latest edition
5. Andrew Tanenbaum, " Computer networks" , Prentice Hall
6. D. Comer, " Computer Networks and Internet/TCP-IP" , Prentice Hall 7. William Stallings, " Data and computer communications" , Prentice Hall

Course Outcomes: At the end of this course students will demonstrate the ability to:
1. Visualise the different aspects of networks, protocols and network design models.
2. Examine various Data Link layer design issues and Data Link protocols.
3. Analyse and compare different LAN protocols.
4. Compare and select appropriate routing algorithms for a network.
5. Examine the important aspects and functions of network layer, transport layer and application layer in internetworking.

Course code	27ECEOM-303-H				
Category	Minor Degree Course				
Course title	COMPUTER NETWORK Lab				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester-V**
	0	**0**	**2**	**1**	
Internal Lab	5 Marks				
External lab	20 Marks				
Total	25 Marks				
Duration of Exam	03 Hours				

Note: A minimum of eight experiments to be performed by the student.

Course Objectives:

CO1: Develop practical skills in configuring and troubleshooting computer networks using network utilities and services such as Ping, Traceroute, ARP, NSLOOKUP, TELNET, and FTP.

CO2: Design, simulate, and analyze various network topologies, protocols, and communication scenarios using network simulation tools such as Cisco Packet Tracer, NS2/NS3, OMNeT++, and NetSim.
CO3: Understand and evaluate the operation of network-layer and transport-layer protocols, including IP addressing, routing algorithms, RIP, OSPF, TCP connection establishment, congestion control, and wireless LAN performance.
CO4: Implement and analyze network algorithms and security mechanisms, including distance-vector and link-state routing, CSMA/CD performance, encryption/decryption techniques, and protocol behavior under different network conditions.

Course Outcomes: At the end of the Course, the student will have the ability to:

CO1	Define fundamental concepts of different types of transmission media.
CO2	Understand various digital modulation techniques
CO3	Demonstrate LAN using different topologies like bus, ring, star & tree.
CO4	Analyze the operation for configuration of modem and hub

Mapping of Course Outcomes to Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	-	-	-	3	-	-	-	-	-	-	-	-	-	2
CO2	1	3		3	3	-	2	-	-	-	2	2	1	-	2
CO3	3	1	3	3	3	3	2	2	1	2	2	-	3	-	3
CO4	1	3	-	3	-	-	-	-	1	-	-	-	3	1	-

1. Running and using services/commands like ping, trace route, NSLOOKUP, ARP, TELNET, FTP, etc.
2. Network simulation using tools like Cisco Packet Tracer, NetSim, OMNeT++, NS2, NS3, etc.
3. Network Topology – Star, Bus, Ring
4. Simulate the transmission of ping messaged over a network topology and find the number of packets dropped due to congestion.
5. Understanding IP Addressing using the simulation tool.
6. Study of various application protocols using the simulation like FTP, HTTP
7. Understand IP forwarding within a LAN and across a router
8. Understand the working of "Connection Establishment" in TCP using Network simulation using tools
9. Study how the Data Rate of a Wireless LAN (IEEE 802.11b) network varies as the distance between the Access Point and the wireless nodes is varied
10. Study the working and routing table formation of Interior routing protocols, i.e. Routing Information Protocol (RIP) and Open Shortest Path First (OSPF)
11. To determine the optimum persistence of a CSMA / CD network
12. Implementation of distance vector routing algorithm
13. Implementation of Link state routing algorithm
14. Study of Network simulator (NS) and simulation of Congestion Control Algorithms using NS
15. Encryption and decryption.

Course code	27ECEOM-302-H				
Category	Minor Degree Course				
Course title	**Microprocessors and Interfacing**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester-VI**
	3	0	0	3	
Classwork	25 Marks				
Examination	50 Marks				
Total	75 Marks				
Duration of Exam	03 Hours				

Note: The examiner will set a total of 9 questions. Question one will carry questions from all units, and the remaining eight questions will be set by taking two questions from each unit. The students have to attempt five questions in total, with the first being compulsory and selecting one from each unit. All questions will carry equal marks.

Course Objectives:

1. To make understand architecture and working of Intel 8085 microprocessor in depth.
2. To make understand architecture and working of Intel 8086 microprocessor in depth.
3. Familiarization with the assembly language programming.
4. Familiarization with various peripheral operations.

COURSE OUTCOMES (CO):

By the end of the Course, Students will be able to:

CO1: Understand the operation and architecture of Intel 8085 microprocessor including Instruction Set Architecture, assembly language programming, timing and speed of operation.

CO2: Learn the operation of circuits for user interaction through switches, keyboard and display devices.

CO3: Understand the operation and architecture of Intel 8086 microprocessor including Instruction Set Architecture, assembly language programming, timing and speed ofoperation.

CO4: Understand the motivation and need for peripheral operations circuits for digital data exchange, timer, serial communication, merits of direct memory access, interrupt controller and other circuits.

CO - PO mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PSO1	PSO2	PSO3

CO1	3	2	1	1	2	-	-	-	-	-	2	3	2	1
CO2	3	2	2	2	3	-	-	1	1	-	2	3	3	1
CO3	3	3	2	2	2	-	-	1	1	-	2	3	3	1
CO4	3	3	3	2	3	1	-	1	1	-	3	3	3	2
WT. AVG	3	2.5	2	1.75	2.5	1		1	1		2.25	3	2.75	1.25
Overall Mapping of Subject														2.33

UNIT I

THE 8085 PROCESSOR: Introduction to microprocessor, 8085 microprocessor: Architecture,instruction set, interrupt structure, and Assembly language programming.

UNIT II

THE 8086 MICROPROCESSOR ARCHITECTURE: Architecture, block diagram of 8086, detailsof sub-blocks such as EU, BIU; memory segmentation and physical address computations,program relocation, addressing modes, instruction formats, pin diagram and description ofvarious signals

UNIT III

INSTRUCTION SET OF 8086: Instruction execution timing, assembler instruction format, datatransfer instructions, arithmetic instructions, branch instructions, looping instructions, NOPand HLT instructions, flag manipulation instructions, logical instructions, shift and rotate instructions, directives and operators, programming examples.

Unit IV

INTERFACING DEVICE:8255 Programmable peripheral interface, 8254 (8253) programmable interval timer, 8259A programmableinterrupt controller, and 8237 DMA controller.Interfacing with Memory, Interfacing with A/D and D/A converter. Introduction to advance processors and programming model of X86 family.

Alternative NPTEL/SWAYAM Course:

S. No.	NPTEL Course Name	Instructor	Host Institute
1	Microprocessors and Microcontrollers	Prof.IndranilSengupta	IIT Kharagpur
2	Computer Architecture and Organization	Prof.Smruti R. Sarangi	IIT Delhi

TEXT BOOKS:

1. Microprocessor Architecture, Programming & Applications with 8085: Ramesh S Gaonkar; Wiley Eastern Ltd.
2. Intel Microprocessors 8086- Pentium processor: Brey; PHI

REFERENCE BOOKS:

1. Microprocessors and interfacing: D V Hall; TMH
2. The 8088 & 8086 Microprocessors-Programming, interfacing, Hardware & Applications: Triebel& Singh; PHI
3. Microcomputer systems: the 8086/8088 Family: architecture, Programming &Design: Yu-Chang Liu & Glenn A Gibson; PHI.
4. Advanced Microprocessors and Interfacing: Badri Ram; TMH

Course code	27ECEOM-304-H				
Category	Minor Degree Course				
Course title	**Microprocessor and InterfacingLab**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester-VI**
	0	**0**	**2**	**1**	
Internal Lab	05 Marks				
External lab	20 Marks				
Total	25 Marks				
Duration of Exam	03 Hours				

Course Objective: Write, debug, and optimize Assembly Language Programs for different applications and demonstrate system interfacing with external devices and peripherals.

CO1: Understand the architecture, instruction set, addressing modes, and programming model of microprocessors/microcontrollers for Assembly Language programming.

CO2: Develop, debug, and optimize Assembly Language Programs to solve a variety of computational and real-time application problems.

CO3: Interface memory, input/output devices, and peripheral modules with microprocessor based systems.

CO4: Design and implement embedded system applications by integrating Assembly Language Programs with hardware interfacing techniques.

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PSO1	PSO2	PSO3
CO1	3	3	2	3	2	-	-	-	-	-	2	2	2	
CO2	3	3	2	3	2	1	-	-	-	-	2	3	2	
CO3	3	3	3	3	2	1	-	-	-	-	2	3	3	2
CO4	3	3	3	3	2	1	-	-	-	-	2	3	3	2
WT. AVG	3	3	2.5	3	2	1					2	2.75	2.5	2
Overall Mapping of Subject														2.41

List of Experiments:

1. To study the architecture of 8086 microprocessor and 8086 microprocessor kit.
2. Write a program to add the contents of the memory location to the content of other memory location and store the result in 3rd memory location.
3. Write a program to add 16 bit number using 8086 instruction set.
4. Write a multiplication of two 16 bit numbers using 8086 instruction set.
5. Write a program for division of two 16 bit numbers using 8086 instruction set.
6. Write a program factorial of a number.
7. Write a Program to transfer a block of data with & without overlap.
8. Write a program to find the average of two numbers.
9. Write a Program to check whether data byte is odd or even
10. Write a program to find maximum number in the array of 10 numbers.
11. Write a program to find the sum of the first 'n' integers.
12. Write a program to generate a square wave.
13. Write a program to generate a rectangular wave.
14. Write a program to generate a triangular wave

Course code	28ECEOM-401-H				
Category	Minor Degree Course				
Course title	**Antennas and Wave Propagation**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester-VII**
	3	1	0	3	
Classwork	25 Marks				
Examination	50 Marks				
Total	75 Marks				
Duration of Exam	03 Hours				

Note: The examiner will set a total of 9 questions. Question one will carry questions from all units, and the remaining eight questions will be set by taking two questions from each unit. The students have to attempt five questions in total, with the first being compulsory and selecting one from each unit. All questions will carry equal marks.

Course Objectives:

CO1: Develop a fundamental understanding of electromagnetic radiation, antenna parameters, radiation mechanisms, and the operating principles of wire and loop antennas.

CO2: Understand the design principles and performance characteristics of aperture, horn, and reflector antennas used in modern communication and radar systems.

CO3: Analyze and design broadband and microstrip antennas using various feeding and analysis techniques for wireless communication applications.

CO4: Study the theory and synthesis of antenna arrays and introduce the concepts of smart antennas, beamforming, and adaptive antenna systems for enhanced wireless communication performance.

Course Outcomes: At the end of the Course, the student will have the ability to:

CO1	Understand the working principles of the Antenna.
CO2	Analyze the properties of different types of antennas and their design
CO3	Design and mathematical analysis of various practical antennas and their feeding methods.
CO4	Analyze performance of various antenna arrays and their comparison.

Mapping of Course Outcomes to Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	-	-	-	2	2	-	2	3	2	3	2	3	2
CO2	3	3	2	2	2	-	-	-	3	2	-	3	2	3	2
CO3	3	3	2	3	3	-	-	-	-	3	-	3	2	3	2
CO4	3	3	-	-	-	-	-	-	2	3	-	2	2	3	2

UNIT I

Fundamental Concepts- Physical concept of radiation, Radiation pattern, near-and far-field regions, reciprocity, directivity and gain, effective aperture, polarization, input impedance, efficiency, Friis transmission equation, radiation integrals and auxiliary potential functions.
Radiation from Wires and Loops- Infinitesimal dipole, finite-length dipole, linear elements near conductors, dipoles for mobile communication, small circular loop.

UNIT 2

Aperture and Reflector Antennas- Huygens' principle, radiation from rectangular and circular apertures, design considerations, Babinet's principle, Radiation from sectoral and pyramidal horns, design concepts, prime-focus parabolic reflector and cassegrain antennas

UNIT 3

Broadband Antennas- Log-periodic and Yagi-Uda antennas, frequency independent antennas, broadcast antennas. Micro strip Antennas- Basic characteristics of micro strip antennas, feeding methods, methods of analysis, design of rectangular and circular patch antennas.

UNIT 4

Antenna Arrays- Analysis of uniformly spaced arrays with uniform and non-uniform excitation amplitudes, extension to planar arrays, synthesis of antenna arrays using Schelkunoff polynomial method, Woodward-Lawson method. Basic Concepts of Smart Antennas- Concept and benefits of smart antennas, fixed weight beam forming basics, Adaptive beam forming.

Text/Reference Books:

1. J.D. Kraus, Antennas, McGraw Hill, 1988.
2. C.A. Balanis, Antenna Theory - Analysis and Design, John Wiley, 1982.
3. R.E. Collin, Antennas and Radio Wave Propagation, McGraw Hill, 1985.
4. R.C. Johnson and H. Jasik, Antenna Engineering Handbook, McGraw ill, 1984.
5. I.J. Bahl and P. Bhartia, Micro Strip Antennas, Artech House, 1980.
6. R.K. Shevgaonkar, Electromagnetic Waves, Tata McGraw Hill, 2005
7. R.E. Crompton, Adaptive Antennas, John Wiley

Project

<table>
<tr><td>Course code</td><td colspan="5">28ECEOM-403-H</td></tr>
<tr><td>Category</td><td colspan="5">Minor Degree Course</td></tr>
<tr><td>Course title</td><td colspan="5">Project</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester VII</td></tr>
<tr><td>0</td><td>0</td><td>2</td><td>1</td></tr>
<tr><td>Internal Assessment</td><td colspan="5">5 Marks</td></tr>
<tr><td>Exam (Semester Exam)</td><td colspan="5">20 Marks</td></tr>
<tr><td>Total</td><td colspan="5">25 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Students will be assigned projects individually or in a group of not more than 3 students depending on the efforts required for completion of project.

The project will have 4 stages:

(*Marks for internal evaluation are given in brackets)

- Synopsis submission (5 marks),
- 1^{st}mid term progress evaluation (5 marks)
- 2^{nd}mid term progress evaluation (5 marks)
- Final submission evaluation (10 marks).

The external examiner will evaluate the project on the basis of idea/quality of project, implementation of the project, project report and viva.