JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY
WAKNAGHAT, P.O. – WAKNAGHAT,
TEHSIL – KANDAGHAT, DISTRICT – SOLAN (H.P.)
PIN – 173234 (INDIA) Phone Number- +91-1792-257999
(Established by H.P. State Legislature vide Act No. 14 of 2002)

JAYPEE EDUSPHERE
IGNITED MINDS
INSPIRED SOULS

List of all the Value Added Courses Offered during 2023-24

S. No	Course Code	Course Name
1	18B2WCI714	INTRODUCTION TO INTERNET OF THINGS
2	18B1WCI740	COMPUTATIONAL TECHNIQUES AND ALGORITHMS IN ENGINEERING
3	21B2WCI701	NATURAL LANGUAGE PROCESSING
4	18B1WCI843	DATA ANALYTICS
5	18B11EC611	WIRELESS AND DATA COMMUNICATION
6	18B11EC312	DIGITAL ELECTRONICS & LOGIC DESIGN
7	18B17EC372	DIGITAL ELECTRONICS & LOGIC DESIGN LAB
8	18B11EC512	MICROPROCESSOR AND INTERFACING
9	18B17EC572	MICROPROCESSOR AND INTERFACING LAB
10	18B11EC413	MODERN ANALOG AND DIGITAL COMMUNICATION
11	18B1WEC747	INTERNET OF THINGS
12	21B1WEC731	DIGITAL IMAGE PROCESSING USING PYTHON
13	18B1WEC843	INDUSTRIAL INTERNET OF THINGS
14	18B1WEC845	SATELLITE COMMUNICATION
15	18B17EC673	ADVANCE COMMUNICATION LAB
16	20B1WEC731	AUTOMATION AND ROBOTICS
17	18B2WCI714	INTRODUCTION TO INTERNET OF THINGS

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18	18B1WCI740	COMPUTATIONAL TECHNIQUES AND ALGORITHMS IN ENGINEERING
19	21B2WCI701	NATURAL LANGUAGE PROCESSING
20	18B1WCI843	DATA ANALYTICS
21	2024-CC-BT	Certificate Course on Industrial Plant Tissue Culture

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JAYPEE EDUSPHERE
IGNITED MINDS INSPIRED SOULS

Date: May 06, 2023 (Sat)

NOTICE

This is to inform you that the following value added courses will be offered to the students in various departments in the ensuing semester (Odd Semester 2023).

S. No	Course Code	Course Name
1	20B1WEC731	AUTOMATION AND ROBOTICS
2	18B1WCI740	COMPUTATIONAL TECHNIQUES AND ALGORITHMS IN ENGINEERING
3	18B11EC312	DIGITAL ELECTRONICS & LOGIC DESIGN
4	18B17EC372	DIGITAL ELECTRONICS & LOGIC DESIGN LAB
5	21B1WEC731	DIGITAL IMAGE PROCESSING USING PYTHON
6	18B1WEC747	INTERNET OF THINGS
7	18B2WCI714	INTRODUCTION TO INTERNET OF THINGS
8	18B11EC512	MICROPROCESSOR AND INTERFACING
9	18B17EC572	MICROPROCESSOR AND INTERFACING LAB
10	21B2WCI701	NATURAL LANGUAGE PROCESSING

Course Duration: 42 hours

- Classes will be held as per Time-Table, notified at the beginning of the semester.
- It is mandatory for all registered students of respective departments to attend classes.

(Dr. Ashok Kumar Gupta)
Professor and Dean (Academics & Research)
JUIT

Jaypee University of Information Technology * Waknaghat * Dean (A&R)

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JAYPEE EDUSPHERE
IGNITED MINDS
INSPIRED SOULS

Date: Dec 04, 2023 (Mon)

NOTICE

This is to inform you that the following value added courses will be offered to the students in various departments in the ensuing semester (Even Semester 2024).

S. No	Course Code	Course Name
1	18B17EC673	ADVANCE COMMUNICATION LAB
2	18B1WCI843	DATA ANALYTICS
3	18B1WEC843	INDUSTRIAL INTERNET OF THINGS
4	18B11EC413	MODERN ANALOG AND DIGITAL COMMUNICATION
5	18B1WEC845	SATELLITE COMMUNICATION
6	18B11EC611	WIRELESS AND DATA COMMUNICATION
7	2024-CC-BT	Certificate Course on Industrial Plant Tissue Culture

Course Duration: 42 hours

- Classes will be held as per Time-Table, notified at the beginning of the semester.
- It is mandatory for all registered students of respective departments to attend classes.

(Prof. (Dr.) Ashok Kumar Gupta)
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Internet of Things (IoT)

COURSE CODE : 18B1WEC747

COURSE CREDITS: 03

CORE/ELECTIVE: Elective

Pre-requisite: Basics of communication systems

Course Objectives:

The primary objective of this course is

1. To provide an understanding of IoT
2. To introduce and familiarize with the recent developments in the domain of IoT and their applications.
3. To develop a deep understanding of technologies in the development of IoT applications.
4. To analyse IoT system through case studies and to implement basic IoT applications.

Course Contents:

Unit	Contents	Lectures required
1	Introduction to IoT, Sensing, Actuation , Basics of wireless technologies.	**6**
2	Basics of Networking: Communication Protocols , Connectivity Technology, Sensor Networks, UAV Networks, Machine to Machine Communication.	**9**
3	Introduction to SDN, SDN for IoT SDN for IoT, Data Handling and Analytics, Cloud Computing, Sensor-Cloud, Fog Computing, Interoperability in IoT, Introduction to Aurdino, Integration of Sensor and Actuator with Aurdino.	**11**
4	Smart Cities and Smart Home, Connected Vehicles, Smart Grid, Industrial Internet of Things.	**9**
5	Case Studies: Agriculture, Case Study: Healthcare, Case Study-Activity Monitoring.	**8**
Total lectures		**42**

Suggested Text Book(s):

1. The Internet of Things: Enabling Technologies, Platforms, and Use Cases", by Pethuru Raj and Anupama C. Raman (CRC Press)
2. "Internet of Things: A Hands-on Approach", by Arshdeep Bahga and Vijay Madisetti (Universities Press)

Suggested Reference Book(s):

1. The internet of things, Samuel Greengard, 2020 The MIT Press
2. Internet of Things: Architectures, Protocols and Standards 1st Edition

Other useful resource(s):

1. https://nptel.ac.in/noc/courses/noc19/SEM1/noc19-cs31/
2. https://onlinecourses.nptel.ac.in/noc17_cs22/preview
3. https://onlinecourses.nptel.ac.in/noc19_cs32/preview

Evaluation Scheme:

S. No	Exam	Marks	Duration	Coverage / Scope of Examination
1	T-1	15	1 Hour.	Syllabus covered upto T-1
2	T-2	25	1.5 Hours	Syllabus covered upto T-2
3.	T-3	35	2 Hours	Entire Syllabus
4.	Teaching Assessment	25	Entire Semester	Assignment (2) - 10 Quizzes (2) - 10 Attendance - 5

Course Outcomes (COs) contribution to the Programme Outcomes (POs)

Course outcomes (Internet of Things)	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	Average
CO-1	3	3	3	3	3	3	3	3	3	3	3	3	3
CO-2	3	3	3	3	3	3	3	3	3	3	3	3	3
CO-3	3	3	3	3	3	3	3	2	2	2	2	2	2.6
CO-4	3	3	3	3	3	2	3	3	3	3	3	3	2.9
Average	3	3	3	3	3	2.75	3	2.75	2.75	2.75	2.75	2.75	

Data Analytics

COURSE CODE: 18B1WCI843

COURSE CREDIT: 3

CORE/ELECTIVE: ELECTIVE

L-T-P: 3-0-0

Pre-requisites: Linear algebra, calculus, probability theory and statistics

Course Objectives:

Data Analytics is the science of analyzing data to convert information to useful knowledge. This knowledge could help us understand our world better, and in many contexts enable us to make better decisions. While this is the broad and grand objective, the last 20 years has seen steeply decreasing costs to gather, store, and process data, creating an even stronger motivation for the use of empirical approaches to problem solving.

Course outcomes:

S.No.	Course outcomes	Level of Attainment
CO-1	Gaining factual knowledge regarding data acquisition, data cleansing, and various aspects of data analytics and visualization	Familiarity
CO-2	Learning the principles of data analytics and its underlying methods and algorithms	Assessment
CO-3	Learning to apply the methods of data collection and data analytics to solve business and related problems in support of business decision- making	Assessment
CO-4	Developing the skills necessary to use related software tools to perform data collection, cleansing, and analytics	Usage

Course Contents:

Unit	Contents	Lectures required
1	Introduction to the course, Descriptive Statistics, Probability Distributions	**5**
2	Inferential Statistics through hypothesis tests, Permutation & Randomization Test	**4**
3	Regression, ANOVA(Analysis of Variance)	**5**
4	Differentiating algorithmic and model based frameworks Regression : Ordinary Least Squares, Ridge Regression, Lasso Regression, K Nearest Neighbours Regression & Classification	**7**
5	Bias-Variance Dichotomy, Model Validation Approaches Logistic Regression, Linear Discriminant Analysis Quadratic Discriminant Analysis Regression and Classification Trees Support Vector Machines	**8**
6	Ensemble Methods: Random Forest, Neural Networks, Deep learning	**4**
7	Clustering, Associative Rule Mining, Challenges for big data anlalytics	**4**
8	Creating data for analytics through designed experiments, Creating data for analytics through Active learning Creating, data for analytics through Reinforcement learning	**5**
Total lectures		**42**

Approved in Academic Council held on 28 July 2021

Suggested Reference Book(s):

1 Hastie, Trevor, et al. The elements of statistical learning. Vol. 2. No. 1. New York: Springer, 2009.

2. Montgomery, Douglas C., and George C. Runger. Applied statistics and probability for engineers. John Wiley & Sons, 2010.

Other useful resource(s):

1. Link to NPTEL course contents: https://onlinecourses.nptel.ac.in/noc15_mg05/preview

Evaluation Scheme:

S. No	Exam	Marks	Duration	Coverage / Scope of Examination
1	T-1	15	1 Hour.	Syllabus covered upto T-1
2	T-2	25	1.5 Hours	Syllabus covered upto T-2
3.	T-3	35	2 Hours	Entire Syllabus
4.	Teaching Assessment	25	Entire Semester	Assignment (2) - 10 Quizzes (2) - 10 Attendance - 5

Course Outcomes (COs) contribution to the Programme Outcomes(POs)

Course outcomes (Data Analytics)	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	Average
CO-1	2	2	2	2	2	1	1	1	2	2	2	2	**1.8**
CO-2	2	3	3	3	3	1	1	1	2	2	1	2	**2**
CO-3	2	2	2	2	3	1	1	1	2	2	1	2	**1.8**
CO-4	2	3	3	3	2	1	1	1	2	3	2	2	**2.1**
Average	**2**	**2.5**	**2.5**	**2.5**	**2.5**	**1**	**1**	**1**	**2**	**2.3**	**1.5**	**2**	

Advance Communication Lab

COURSE CODE: 18B17EC673

COURSE CREDITS: 1

CORE/ELECTIVE: CORE

L-T-P: 0-0-2

Pre-requisite: None

Course Objectives:

1. Understand the concepts of various digital modulation techniques.
2. To get familiar with the practical implementation of various communication systems.

Course Outcomes:

S.No.	Course Outcomes	Level of Attainment
CO-1	Understand the basics of LabView, MATLab and WiCOMM-T kit	Familiarity
CO-2	Understand the design, application and practical implementation of various digital modulation techniques.	Usage
CO-3	Gain practical experience of the functioning of advance communication systems.	Usage
CO-4	Analyze the performance of communication systems.	Assessment

List of Experiments

S.No	Description	Hours
1	Introduction to LabView, Matlab and WiComm-T (SDR) kit.	2
2	Implementation of Quadrature Phase Shift Keying Modulation and Demodulation system. • Constellation plots • Phase and frequency offset	2
3	Implementation of Quadrature Amplitude Modulation and Demodulation (QAM) • 16-QAM • 64-QAM	2
4	Implementation of Gaussian Minimum Shift Keying (GMSK) modulation and demodulation system.	2
5	Performance analysis of baseband digital communication link.	2
6	Eye diagram measurement for Inter Symbol Interference (ISI).	2
7	To demonstrate Time Division Multiplexing and Demultiplexing.	2
8	To demonstrate Frequency Division Multiplexing and Demultiplexing.	2
9	Implementation of source coding techniques.	2
10	Implementation of channel coding and error control coding techniques.	2
11	To demonstrate GSM communication system.	2
12	To demonstrate OFDM communication system.	2
Total Lab hours		24

Suggested/Resources:

1. T.S. Rappaport, "Wireless Communication", 2nd Edition, Prentice Hall, 2002.
2. Lazos Hanzo: OFDM and MC-CDMA:a primer, 1st Edition, Wiley-IEEE Press, 2006.

Evaluation Scheme:

1	Mid Sem. Evaluation	20 Marks
2	End Sem. Evaluation	20 Marks
3	Attendance	15 Marks
4	Lab Assessment	45 Marks
	Total	100 marks

Approved in Academic Council held on 25.10.2018

Course Outcomes (COs) contribution to the Programme Outcomes (POs)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	Average
CO1	3	3	2	2	3	2	1	2	1	2	1	3	2.08
CO2	3	3	3	3	3	1	1	1	1	1	1	3	2.00
CO3	3	3	3	3	2	1	1	1	1	2	1	3	2.00
CO4	3	3	3	3	2	1	1	1	1	1	1	3	1.92
Average	3.00	3.00	2.75	2.75	2.50	1.25	1.00	1.25	1.00	1.50	1.00	3.00	

Automation and Robotics

COURSE CODE: 20B1WEC731

COURSE CREDITS: 3

CORE/ELECTIVE: ELECTIVE

L-T-P: 3-0-0

Prerequisite: None

Course Objectives:

1. To develop the student's knowledge in various robot structures and their workspace.
2. To use the robotic system for logic building & programming and to solve many engineering problems.

Course Outcomes:

Sl. No.	Course Outcomes	Level of Attainment
1	Learn about brief history, types, requirement and architecture of automation, and their applications	Familiarity
2	Learn about PLC, DCS and SCADA, and their applications	Assessment
2	Learn basic principles of robotics, its configurations, kinematics, dynamics, motion planning and control	Assessment
3	Acquire knowledge about the principles of various sensors, actuators and their applications in robots.	Assessment
4	Understand the concept of dynamics and control for a typical pick and place robot.	Usage

Course Contents:

Unit	Contents	Lectures required
1	Introduction: History of automation, Automation systems, types of automation, Automation overview, Requirement of automation systems, Architecture of Industrial Automation system, Advantages and limitations of Automation, Industrial revolutions.	6
2	Automation components: Sensors and actuators, Electric, Hydraulic, Pneumatic, actuators, process control valves, Introduction of DC and AC servo drives for motion control. Controllers, Transmitters and Signal Conditioning: Need of transmitters, Standardization of signals, Current, Voltage and Pneumatic signal standards, 2-Wire & 3-Wire transmitters, Analog and Digital signal conditioning for sensors, Smart and Intelligent transmitters	8
3	PLC, SCADA & Distributed control system: Elements of SCADA, Features of SCADA, MTU, RTU Functions, Applications of SCADA, Communications in SCADA, Introduction to DCS, Architecture, Input and output modules, Specifications of DCS	6

4	Introduction to Robotics: Definition of robot, types of robots, classification and usage, Terminology of robotics, Specifications of robot, Architecture of robotic systems, Robot Sensors and Machine Vision System: Internal and external sensors: position, velocity and acceleration sensors, proximity sensors, force sensors, laser range finder; Robot vision: image processing fundamentals for robotic applications	8
5	Robot Arm Kinematics and Dynamics:Position and orientation of a rigid body, Homogeneous transformations, Forward kinematics, Inverse kinematics, Lagrange formulation of dynamics	6
6	Motion Planning and Control: Joint and Cartesian space trajectory planning and generation, Classical control concepts using the example of control of a single link and two-link manipulators, Independent joint PD and PID control, Control of a multi-link manipulator	6
Total lectures		42

Suggested Text Book(s):

1. J. J. Craig, “Introduction to Robotics- Mechanics and Control”, Pearson,3rd Edition, 2009.
2. Spong and Vidyasagar, “Robot Dynamics and Control”, Wiley Student Edition, John Wiley and Sons, 2013.
3. Madhuchhanda Mitra, SamarjitSen Gupta, “Programmable Logic controllers and Industrial Automation”, Penram International, 2008
4. C.D. Johnson, “Process Control Instrumentation Technology”, 8th Ed., PHI, 2015

Suggested Reference Book(s):

1. Sciavicco and Siciliano, “Modeling and Control of Robot Manipulators”, Springer, 2nd Edition, 2002.
2. D.K. Pratihar, “Fundamentals of Robotics”, Narosa Publishing House, 1st Edition, 2017.
3. AshitavaGhoshal, “Robotics-Fundamental Concepts and Analysis”, Oxford University Press, 6thImpression, 2010. 8.
4. R. K. Mittal and I. J. Nagrath, “Robotics and Control”, Tata McGraw Hill, New Delhi, 4th Reprint, 2005.
5. Gregory K. McMillan, P. Hunter Vegas, “Process / Industrial Instruments and Controls Handbook,” 6th Ed., McGraw Hill, 2019
6. Bela G. Liptak, KrisztaVenczel, “Instrument and Automation Engineers' Handbook: Process Measurement and Analysis,” 5th Ed., CRC Press, 2016

Other useful resource(s):

1. Link to NPTEL course contents:https://nptel.ac.in/courses/112101099/
2. Other links to course material: https://nptel.ac.in/downloads/112101098/
3. Material provided by IIT Bombay under eLSI project: http://elsi.e-yantra.org/resources

Evaluation Scheme:

S. No	Exam	Marks	Duration	Coverage / Scope of Examination
1	T-1	15	1 Hour.	Syllabus covered up to T-1
2	T-2	25	1.5 Hours	Syllabus covered up to T-2
3	T-3	35	2 Hours	Entire Syllabus

.				
4.	Teaching Assessment	25	Entire Semester	Assignment (2) - 10 Quizzes (2) - 10 Attendance - 5

Course Outcomes (COs) contribution to the Programme Outcomes (POs)

Course outcomes (Automation and Robotics)	**PO-1**	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**	**PO-11**	**PO-12**	**Average**
CO-1	2	2	2	2	2	2	2	1	1	2	2	2	**1.8**
CO-2	3	3	3	2	3	2	2	1	1	2	3	3	**2.3**
CO-3	3	3	3	3	3	3	3	1	2	3	3	3	**2.8**
CO-4	3	3	3	3	3	3	3	1	2	3	3	3	**2.8**
CO-5	3	3	3	3	3	3	3	1	2	3	3	3	**2.8**
Average	**2.8**	**2.8**	**2.8**	**2.6**	**2.8**	**2.6**	**2.6**	**1**	**1.6**	**2.6**	**2.8**	**2.8**	

Computational Techniques and Algorithms in Engineering

Course Details
Course Code:
Level:
Semester:
Instructor:
Outline Course Description:

Unit I

Matrix Vector and Matrix Matrix Multiplication Algorithms, Gaussian Elimination and Its Variants, Systems of Linear Equations, Triangular Systems, Positive Definite Systems, Cholesky Decomposition, Banded Positive Definite Systems, Sparse Positive Definite Systems, Gaussian Elimination and the LU Decomposition, Gaussian Elimination with Pivoting, Sparse Gaussian Elimination.

Unit II

Sensitivity of Linear Systems,Vector and Matrix Norms, Condition Numbers, Perturbing the Coefficient Matrix, A Posteriori Error Analysis Using the Residual, Roundoff Errors, Backward Stability, Propagation of Roundoff Errors, Backward Error Analysis of Gaussian Elimination,Scaling, Componentwise Sensitivity Analysis.

Unit-III

The Least Squares Problem, The Discrete Least Squares Problem, Orthogonal Matrices, Rotators, and Reflectors, Solution of the Least Squares Problem, The Gram-Schmidt Process, Geometric Approach, Updating the QR Decomposition.

Unit IV

The Singular Value Decomposition, Some Basic Applications of Singular Values,The SVD and the Least Squares Problem, Sensitivity of the Least Squares Problem.

Unit V

Eigenvalues and Eigenvectors, Systems of Differential Equations, The Power Method and Some Simple Extensions, Similarity Transforms, Reduction to Hessenberg and Tridiagonal Forms, The QR Algorithm, Implementation of the QR algorithm, Use of the QR Algorithm to Calculate Eigenvectors.

Unit VI

Iterative Methods for Linear Systems, The Classical Iterative Methods, Convergence of Iterative Methods, Descent Methods; Steepest Descent, Preconditioners, The Conjugate-Gradient Method, Derivation of the CG Algorithm, Convergence of the CG Algorithm, Indefinite and Nonsymmetric Problems.

Assumed Background:

A basic background in engineering mathematics and computational techniques is assumed. In particular, it is assumed that the student has a basic understanding of linear algebra, probability theory, on which the more advanced material in this course will be built.

Course Aims

An course is designed to deepen student knowledge and capability in computational techniques in areas of particular importance to engineering. The course aims to give students the computational tools and theory needed for developing efficient algorithms to solve engineering problems. Specifically, the aim is ensure the student has excellent skills in

numerical implementation of advanced methods in linear algebra. The students will be required to use MATLAB as an tool for their work during the course.

Course Outcomes(COs)

Course outcomes (19B1WCI531: Computational Techniques and Algorithms in Engineering)		**Level of Attainment**
CO-1	Solve systems of linear equations using multiple methods, including Gaussian elimination and matrix inversion. Algorithms for vector and matrix operations,.	Usage
CO-2	Positive Definite Systems, Cholesky Decomposition, LU Decomposition, Sensitivity and roundoff errors	Usage
CO-3	Least Squares Problem, OR Decomposition	Usage
CO-4	SVD and QR algorithm	Usage
CO-5	,Determine eigenvalues and eigenvectors and solve eigenvalue problems	Assessment
CO-6	Iterative algorithms and Convergence	Assessment

Detailed Description

19B1WCI531: Computational Techniques and Algorithms in Engineering

Matrix Vector and Matrix Matrix Multiplication Algorithms, Gaussian Elimination and Its Variants, Systems of Linear Equations, Triangular Systems, Positive Definite Systems, Cholesky Decomposition, Banded Positive Definite Systems, Sparse Positive Definite Systems, Gaussian Elimination and the LU Decomposition, Gaussian Elimination with Pivoting, Sparse Gaussian Elimination	L1-5
Sensitivity of Linear Systems,Vector and Matrix Norms, Condition Numbers, Perturbing the Coefficient Matrix, A Posteriori Error Analysis Using the Residual, Roundoff Errors, Backward Stability, Propagation of Roundoff Errors, Backward Error Analysis of Gaussian Elimination,Scaling, Componentwise Sensitivity Analysis	L6-11
The Least Squares Problem, The Discrete Least Squares Problem, Orthogonal Matrices, Rotators, and Reflectors, Solution of the Least Squares Problem, The Gram-Schmidt Process, Geometric Approach, Updating the QR Decomposition	L12-19
The Singular Value Decomposition, Some Basic Applications of Singular Values,The SVD and the Least Squares Problem, Sensitivity of the Least Squares Problem	L20-23
Eigenvalues and Eigenvectors, Systems of Differential Equations, The Power Method and Some Simple Extensions, Similarity Transforms, Reduction to Hessenberg and Tridiagonal Forms, The QR Algorithm, Implementation of the QR algorithm	L24-30
Iterative Methods for Linear Systems, The Classical Iterative Methods, Convergence of Iterative Methods, Descent Methods; Steepest Descent,	L36-42

Preconditioners, The Conjugate-Gradient Method, Derivation of the CG Algorithm, Convergence of the CG Algorithm, Indefinite and Nonsymmetric Problems.	

Evaluation scheme:

Test 1	15
Test 2	25
Test 3	35
Internal	25(quiz=12,Assignment=9,Regularity=4)
Total	100 marks

Text Book

Fundamentals of Matrix Computations, DAVID S. WATKINS
Linear Algebra Done Right, by Sheldon Axler

References

The following is an excellent text for reviewing fundamental concepts and some applications of linear algebra.

- Gilbert Strang, Linear Algebra and Its Applications, 4th Edition, Brooks Cole, 2006.
- Gene H. Golub and Charles F. Van Loan, Matrix Computations, 3rd edition, John Hopkins University Press, 1996, ISBN 0-8018-5414-8.
- Lloyd N. Trefethen and D. Bau III, Numerical Linear Algebra, SIAM, 1997.
- James W. Demmel, Applied Numerical Linear Algebra, SIAM, 1997.

References on Iterative Methods and Multigrid Methods
The following books are for additional readings on iterative methods and multigrid methods, which are increasingly important but not covered in this course due to time constraint.

- Anne Greenbaum, Iterative Methods for Solving Linear Systems, SIAM, 1997.
- Yousef Saad, Iterative Methods for Sparse Linear Systems, SIAM, 2003.
- William L. Briggs, Van Emden Henson, Steve F. McCormick, A Multigrid Tutorial, 2nd edition, SIAM, 2000.

References on C Programming
If you want to purchase a C book, a classical one is

- B.W. Kernighan, D.M. Ritchie, C Programming Language (2nd edition). Prentice Hall, 1988.
- M. Banahan, D. Brady and M. Doran, The C Book, second edition, Addison Wesley, 1991.
- C Programming, Wikibooks

CO-PO-PSO Articulation Matrix

	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	
CO-1	3	2	3	2	2	3	2	3	2	2	3	3	83.3
CO-2	3	2	3	2	2	3	3	2	2	3	3	3	86.1
CO-3	2	2	2	2	2	3	3	3	2	2	3	3	80.6
CO-4	3	2	3	2	3	2	2	3	3	3	2	2	83.3
CO-5	3	2	2	2	3	2	2	2	2	3	3	3	80.6
CO-6	2	3	3	3	3	2	3	2	2	3	3	2	86.1
	88.9	72.2	88.9	72.2	83.3	83.3	83.3	83.3	72.2	88.9	94.4	88.9	

PO-1. Engineering knowledge
PO-2. Problem analysis
PO-3. Design/development of solutions
PO-4. Conduct investigations of complex problems
PO-5. Modern tool usage
PO-6. The engineer and society
PO-7. Environment and sustainability
PO-8. Ethics
PO-9. Individual and team work
PO-10. Communication
PO-11. Project management and finance
PO-12. Life-long learning

Attainment of PSOs through COs					
Sr No	**PSO-1**	**PSO-2**	**PSO-3**	**PSO-4**	
CO-1	**3**	**2**	**2**	**2**	**79**
CO-2	**2**	**3**	**2**	**3**	**79**
CO-3	**3**	**2**	**3**	**2**	**81**
CO-4	**2**	**2**	**2**	**2**	**75**
CO-5	**2**	**3**	**2**	**3**	**79**
CO-6	**3**	**2**	**3**	**2**	**79**

Average Score	**81**	**82**	**85**	**76**	

Program Specific Outcomes	
PSO-1	**Detailed Knowledge of contemporary issues in CSE.**
PSO-2	**Strong skills in learning new programming environments.**
PSO-3	**Ability to analyse, design, model, develop , test and manage complex software and information management systems.**
PSO-4	**Analysing the impact of Computer Science and Engineering solutions in the societal and human context.**

Digital Image Processing using Python

COURSE CODE:

COURSE CREDITS:

CORE/ELECTIVE: ELECTIVE

L-T-P:

Pre-requisite: Python

Course Objectives:

1. To introduce various fundamentals of Digital Image Processing.
2. To provide hands-on practice on different image processing methods using python.

Course Outcomes:

Sl. No.	Course Outcomes	Level of Attainment
CO-1	Able to understand the process of image acquisition.	Familiarity
CO-2	Able to implement different image processing methods for enhancement, edge detection and segmentation.	Assessment
CO-3	Able to implement different image processing methods on python	Usage
CO-4	Understand the concept of machine learning in images.	Familiarity

Course Contents:

Unit	Contents	Lectures required
1	**Introduction to Image Processing:-** Acquisition of Images, Image Sampling and quantization, Intensity and Spatial Resolution of Images.	**7**
2	**Introduction to Python and OpenCV:** Introduction to Numpy, Pandas, and OpenCV. Implementation of basic functions like reading & writing an image, cropping, resizing, rotation of images.	**7**
3	**Image enhancement:** Histogram and contrast on an image, point processing of an image, processing in spatial domain, processing in spectral domain, noise modeling. Implementation of enhancement methods using python.	8
4	**Edge Detection:** Point detection, line detection, different gradient operators, Laplacian operator, and Canny edge detection. Implementation of edge detection using python.	8
5	**Image Segmentation:** Intensity thresholding based image segmentation; Region growing and region splitting algorithm; watershed segmentation. Implementation of	**7**

	segmentation methods using python.	
6	**Machine Learning based Image Processing:** Introduction to Machine Learning and convolutional neural network.	**5**
Total lectures		**42**

Suggested Text Book(s):

1. RC Gonzalez, RE Woods, Digital Image Processing, 3rd Ed., Pearson Publisher, 2008.
2. Ravishankar chityala, Sridevi Pudipeddi, Image Processing and Acquisition using Python, 2nd Ed., CRC Press, 2020.

Suggested Reference Book(s):

1. Chris Solomon, Toby Breckon: Fundamental of Digital Image Processing, 1st Ed., John Wiley & Sons, 2011.
2. Jan Erik Solem, Programming Computer Vision with Python: Tools and Algorithms for Analyzing Images, O'Reilly Media, 2012

Other useful resource(s):

1. https://nptel.ac.in/courses/108/103/108103174/ (Prof. M.K. Bhuyan, Electrical Engineering, IIT Guwahati)
2. https://docs.opencv.org/4.x/d9/df8/tutorial_root.html

Evaluation Scheme:

S. No	Exam	Marks	Duration	Coverage / Scope of Examination
1	T-1	15	1 Hour.	Syllabus covered up to T-1
2	T-2	25	1.5 Hours	Syllabus covered up to T-2
3.	T-3	35	2 Hours	Entire Syllabus
4.	Teaching Assessment	25	Entire Semester	Assignment (2) - 10 Quizzes (2) - 10 Attendance - 5

Course Outcomes (COs) contribution to the Programme Outcomes(POs)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	Avg.
CO1	3	3	2	2	2	2	3	1	2	3	3	1	2.2
CO2	3	1	3	2	1	2	3	2	2	3	2	2	2.1
CO3	3	3	2	2	1	2	2	2	3	2	1	2	2.1
CO4	3	2	2	2	2	2	2	2	2	2	2	1	2.0
Avg.	3	2.2	2.2	2	1.5	2.0	2.5	1.7	2.2	2.5	2.0	1.5	

Industrial Internet of Things

COURSE CODE: 18B1WEC839

COURSE CREDITS: 3

CORE/ELECTIVE: ELECTIVE

L-T-P: 3-0-0

Pre-requisite: None

Course Objectives:

1. To understand the concepts of Internet of Things.
2. To automate the industrial process through IoT applications.

Course Outcomes:

S.No.	Course Outcomes	Level of Attainment
CO-1	To Understand the Characteristics of IoT.	Familiarity
CO-2	To provide the basic knowledge of Network & Communication Aspects of IoT.	Familiarity
CO-3	To Design IoT applications in different domain and be able to analyze their performance.	Usage
CO-4	To Implement basic IoT applications on embedded platform.	Assessment

Course Contents:

Unit	Contents	Lectures required
1.	Introduction to IoT: Defining IoT, Characteristics of IoT, Physical design of IoT, Logical design of IoT, Functional blocks of IoT, Communication models & Application Programming Interfaces (APIs).	6
2.	IoT & M2M: Machine to Machine, Difference between IoT and M2M, Software defined Network.	8
3	Network & Communication Aspects: Wireless medium access issues, MAC protocol survey, Survey routing protocols, Sensor deployment & Node discovery, Data aggregation & dissemination.	8
4	Challenges in IoT: Design challenges, Development challenges, Security challenges, Other challenges.	8
6	Domain specific applications of IoT: Home automation, Industry applications, Surveillance applications, Other IoT applications.	6
7	Developing IoTs: Introduction to different IoT tools, Developing applications through IoT tools, Developing sensor based application through embedded system platform, Implementing IoT concepts.	6
	Total Lectures	42

Suggested Text Book(s):

1. Arshdeep Bahga and Vijay Madisetti, “Internet of Things: A Hands-on Approach”,Universities Press, 1st Edition, 2015.
2. Pethuru Raj and Anupama C. Raman, "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", CRC Press, 1st Edition, 2017.

Suggested Reference Book(s):

1. Antonio Capasso and Giacomo Veneri, “Hands-On Industrial Internet of Things: Create a Powerful Industrial IoT Infrastructure Using Industry 4.0”, Pact Publishing Ltd, UK, 1st edition, 2018.
2. Waltenegus Dargie, Christian Poellabauer, "Fundamentals of Wireless Sensor Networks: Theory and Practice", Wiley-Blackwell, 1st Edition, 2010.

Other useful resource(s):

Link to NPTEL course contents: https://onlinecourses.nptel.ac.in/noc17_cs22/preview

Link to topics related to course: https://onlinecourses.nptel.ac.in/noc19_cs32/preview

Evaluation Scheme:

S. No	Exam	Marks	Duration	Coverage / Scope of Examination
1	T-1	15	1 Hour.	Syllabus covered upto T-1
2	T-2	25	1.5 Hours	Syllabus covered upto T-2
3.	T-3	35	2 Hours	Entire Syllabus
4.	Teaching Assessment	25	Entire Semester	Assignment (2) - 10 Quizzes (2) - 10 Attendance - 5

Course Outcomes (COs) contribution to the Programme Outcomes (POs)

Course outcomes (Industrial Internet of Things)	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	Average
CO-1	3	3	3	3	3	3	3	3	3	3	3	3	3
CO-2	3	3	3	3	3	3	3	3	3	3	3	3	3
CO-3	3	3	3	3	3	3	3	2	2	2	2	2	2.6
CO-4	3	3	3	3	3	2	3	3	3	3	3	3	2.9
Average	3	3	3	3	3	2.75	3	2.75	2.75	2.75	2.75	2.75	

Microprocessor and Interfacing Lab

COURSE CODE: 18B17EC572

COURSE CREDITS: 1

CORE/ELECTIVE: CORE

: 0-0-2

Pre-requisite: Digital Electronics & Logic Design Lab

Course Objectives:

1. To develop, implement, and debug 8086 assembly language programs
2. To familiarize the students with memory organization and interfacing of microprocessor with various peripheral devices.

Course Outcomes:

S. No.	Course Outcomes	Level of Attainment
CO-1	Gain proficiency with using assembly language to develop microprocessor based applications	Familiarity
CO-2	Learn control components of a microprocessor based system though the use of interrupts	Usage
CO-3	Gain practical experience in programming memory and peripheral devices like timers/counters, parallel peripheral devices, serial communication interfaces and I/O devices	Usage
CO-4	Gain practical experience in programming with coprocessor and DMA controller	Usage
CO-5	Develop a microprocessor based system, using assembly language programming concepts, for handling a real life task	Assessment

List of Experiments

S. No.	Description	Hours
1	Introduction to 8085/8086 based systems, ET-8085LCD /ET-8086LCD	2
2	To add, subtract, multiply and divide two 16bit nos. stored at locations 1000:0000H and 1000:0002H. Store the results starting from 1000:0004H. Find the total program memory size and number of machine cycles to execute the program.	2
3	To sort an array of 16 bytes stored at memory location starting from 1000:0300H. Store the array in ascending order at memory location starting from 1000:0310H and array in descending order at memory location starting from 1000:0320H.	2
4	To read a temperature in degree centigrade from keyboard when prompted, convert to degree Fahrenheit and display it on the LCD of ET-8086LCD microprocessor trainer kit	2
5	To interface an array of LEDs using 8255 parallel peripheral interface	2
6	To read a sensor input data from Port-A of 8255, filter it and output at Port-B of 8255	2
7	To program the 8253 timer for generating delay	2
8	To use 8259 interrupt controller for interfacing external interrupts	2
9	To communicate between two microprocessor kits using 8251 serial communication interface	2
10	To do floating point operations using mathematical coprocessor 8087	2
11	To do data transfer using DMA controller 8089	2
12	To create, edit and display a text file in PC using BIOS and DOS interrupts	2
	Total Lab hours	24

Suggested Resources:

1. Berry B.Brey, “The Intel Microprocessors : Architecture, Programming, and Interfacing,” 8th Ed., Prentice Hall, 2009.

2. Kenneth Ayala, “The 8051 microcontroller,” 3rd Ed., Thomson, 2005
3. Ramesh Gaonkar, “Microprocessor Architecture, Programming and Applications with the 8085,” 6th Ed., Penram, 2013.
4. Official IA-32 Programmer Reference Manuals online at: https://software.intel.com/en-us/articles/intel-sdm

Evaluation Scheme:

1	Mid Sem. Evaluation	20 Marks
2	End Sem. Evaluation	20 Marks
3	Attendance	15 Marks
4	Lab Assessment	45 Marks
	Total	100 marks

Course Outcomes (COs) contribution to the Programme Outcomes (POs)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	Average
CO1	3	3	3	3	2	2	1	2	3	2	1	3	2.33
CO2	3	3	3	3	1	1	x	x	1	1	x	2	1.50
CO3	3	3	3	3	2	1	x	1	2	2	1	3	2.00
CO4	2	3	1	3	2	x	x	1	x	1	x	3	1.33
CO5	3	3	3	3	2	x	x	2	3	3	3	3	2.33
Average	2.80	3.00	2.60	3.00	1.80	0.80	0.20	1.20	1.80	1.80	1.00	2.80	

Microprocessor and Interfacing

COURSE CODE: 18B11EC512

COURSE CREDITS: 3

CORE/ELECTIVE: CORE

: 3-0-0

Pre-requisite: None

Course Objectives:

1. To study the architecture, instruction set and interfacing of the Intel microprocessors.
2. To gain proficiency in assembly language programming.

Course Outcomes:

S. No.	Course Outcomes	Level of Attainment
CO-1	Understand Standard Architecture of Intel Microprocessors	Familiarity
CO-2	Learn the instruction set of Intel 80x86 processors and to gain proficiency in assembly language programming	Usage
CO-3	Know the concepts associated with interfacing a microprocessor to memory and to I/O devices and to learn the programming of peripheral I/O devices	Usage
CO-4	Learn the control components of a microprocessor based system though the use of interrupts	Assessment
CO-5	Acquaint with the background knowledge for understanding next-generation CPUs	Familiarity

Course Contents:

Unit	Contents	Lectures required
1	Overview of the Intel Family of the Microprocessors. Introduction to 8085 Microprocessor	4
2	The 8086 microprocessor architecture, Addressing Modes; Register Addressing; Immediate Addressing; Direct Data Addressing; Register Indirect Addressing; Base- Plus-Index Addressing; Register Relative Addressing; Base Relative-Plus-Index Addressing	4
3	8086 Instruction Set	4
4	Using assembly language with C/C++; Using Assembly Language with C++ for 16- Bit DOS Applications, Mixed Assembly and C++ Objects	2
5	Programming the 8086 microprocessor; Modular Programming, Using the Keyboard and Video Display, Disk Files	2
6	8086 Hardware specifications; Pin-Outs and the Pin Functions, Clock Generator (8284A), Bus Buffering and Latching, The 8288 Bus Controller	4
7	8086 Memory Interface; Memory Devices, Address Decoding, Memory Interface, Dynamic RAM	4
8	Basic I/O Interface; I/O Port Address Decoding, Programmable Peripheral Interface (8255), Programmable Interval Timer (8254), Programmable Communications Interface (16550), ADC(ADC804) and DAC (DAC830)	6
9	Interrupts; 8259A Interrupt controller	2
10	Direct memory access and DMA-controlled I/O; 8237 DMA controller	2
11	The arithmetic coprocessor; MMX, and SIMD technologies, 8087 arithmetic coprocessor	2
12	Bus interface; ISA Bus, PCI Bus, Parallel Printer Interface, Serial COM Ports, Universal Serial Bus (USB), Accelerated Graphics Port (AGP)	2
13	Intel Pentium and Core2 Processors	4
Total lectures		42

Suggested Text Book(s):

1. Berry B.Brey, “The Intel Microprocessors : Architecture, Programming, and Interfacing,” 8th Ed., Prentice Hall, 2009.
2. Ramesh Gaonkar, “Microprocessor Architecture, Programming and Applications with the 8085,” 6th Ed., Penram, 2013.

Suggested Reference Book(s):

1. Douglas V Hall, “Microprocessors & Interfacing,” 3rd Ed., McGraw Hill, 2017.
2. Yu-Cheng Liu,Glenn A. Gibson , “The 8086/8088 Family Architecture, Programming & design”, 2nd Ed., PHI, 2011.
3. Kenneth Ayala “The 8086 microprocessor programming and Interfacing the PC,” 1st Ed., Cengage Learning, 2007.
4. Tom Shanley, “Protected Mode Software Architecture,” Addison-Wesley, 1996.

Other useful resource(s):

1. NPTEL ONLINE COURSES: Microprocessors and Microcontrollers
   https://nptel.ac.in/courses/106108100/ (Prof. Krishna Kumar ,IISc Bangalore)
   https://nptel.ac.in/courses/108105102/ (Prof. Santanu Chattopadhyay, IIT Kharagpur)

2. MIT OPEN COURSE WARE: Computer System Architecture
   https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-823-computer-system-architecture-fall-2005/ (Dr. Joel Emer, Prof. Krste Asanovic, Prof. Arvind)

Evaluation Scheme:

S. No	Exam	Marks	Duration	Coverage / Scope of Examination
1	T-1	15	1 Hour.	Syllabus covered upto T-1
2	T-2	25	1.5 Hours	Syllabus covered upto T-2
3.	T-3	35	2 Hours	Entire Syllabus
4.	Teaching Assessment	25	Entire Semester	Assignment (2) - 10 Quizzes (2) - 10 Attendance - 5

Course Outcomes (COs) contribution to the Programme Outcomes (POs)

Course Outcomes (Microprocessor and Interfacing)	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	Average
CO1	2	x	3	3	3	2	x	x	x	x	x	1	1.17
CO2	3	3	3	2	2	2	x	x	3	3	2	3	2.17
CO3	3	3	3	3	2	2	x	x	3	2	2	3	2.17
CO4	3	3	3	2	2	3	x	x	1	x	x	3	1.67
CO5	3	3	3	2	3	3	x	x	x	x	x	3	1.67
Average	2.80	2.40	3.00	2.40	2.40	2.40	0.00	0.00	1.40	1.00	0.80	2.60	

Modern Analog and Digital Communication

COURSE CODE: 18B11EC413

COURSE CREDITS: 4

CORE/ELECTIVE: CORE

: 3-1-0

Pre-requisite: None

Course Objectives:

1. Introduce students to basic concepts of analogue and digital communicationsystems.
2. To acquaint the students with various modulation and demodulation techniquesused for communication.

Course Outcomes:

S. No.	Course Outcomes	Level of Attainment
CO1	To familiarize students with the fundamentals of analog and digital communication systems.	Familiarity
CO2	To familiarize students with basic techniques used for modulation and demodulation of signal.	Familiarity
CO3	Understanding of various approaches to convert analog signal to digital signal.	Assessment
CO4	Analyze mathematical background for communication signal analysis.	Assessment
CO5	To analyze performance of a communication system.	Usage

Course Contents:

Unit	Contents	Lectures required
1	Review of fundamental concepts: Review of Fourier series and Fourier transforms, Power Spectral Density, review of probability and random processes, spectral analysis, Gaussian process, Gaussian and white noise characteristics.	4
2	Modulation techniques: Concept of modulation and demodulation, Continuous wave (CW) modulation: AM, DSB, SSB, and VSB modulation, Angle modulation - PM & FM wave equations; relationships between PM and FM. Narrow band FM. Spectra of AM and FM waves. AM and FM detectors. Phase Lock loop (PLL) and its application as FM demodulator, Discriminator, FM Pre-emphasis and De-emphasis, capture effect. Comparison of CW modulation systems. Receivers for CW modulation: Superheterodyne receivers	13
3	Pulse modulation: Sampling process, Pulse modulation: Pulse amplitude modulation (PAM); pulse width modulation (PWM); pulse position modulation (PPM), Quantization, Pulse code modulation (PCM), differential pulse code modulation (DPCM); delta modulation (DM). Noise consideration in PCM and DM. Line coding schemes, Comparison of RZ, NRZ, Polar, Unipolar, Manchester, and their spectral analysis.	7

4	Baseband Pulse Transmission: Baseband transmission, matched filter, probabilty of error of matched filter, Inter symbol Interference and Nyquist criterion, Eye-pattern, Signal to noise ratio.	5
5	Pass band Digital Modulation schemes: Amplitude shift keying (ASK), Phase shift keying (PSK), Frequency shift keying (FSK) and Quadrature amplitude modulation (QAM). Basics of CPFSK and MSK, Signal constellations, Probability of error analysis of digital modulation schemes. Comparison of bandwidth and bit rate of digital modulation schemes. Multiplexers, Timing and frequency synchronization: TDM, FDM, North American Digital Hierarchy, T1 carrier, carrier synchronizers, symbol synchronization, early late gate synchronizer	13
Total lectures		42

Suggested Text Book(s):

1. Simon Haykin, "An introduction to analog and digital communications", 2nd Ed., John Wiley & Sons,2012
2. B.P.Lathi, "Modern Analog and Digital Communication Systems", 4th Ed., Oxford.,2017
3. Taub Schilling, "Principles of Communication Systems", 4th Ed., McGrawHill.,2007

Other useful resource(s):

1. https://nptel.ac.in/courses/117101051/ (Prof. Bikash Kumar Dey, IIT Bombay)
2. https://onlinecourses.nptel.ac.in/noc17_ec11/preview (Prof. Goutam Das, IIT Kharagpur)

Evaluation Scheme:

S. No	Exam	Marks	Duration	Coverage / Scope of Examination
1	T-1	15	1 Hour.	Syllabus covered upto T-1
2	T-2	25	1.5 Hours	Syllabus covered upto T-2
3.	T-3	35	2 Hours	Entire Syllabus
4.	Teaching Assessment	25	Entire Semester	Assignment (2) - 10 Quizzes (2) - 10 Attendance - 5

Course Outcomes (COs) contribution to the Programme Outcomes(POs)

Course Outcomes (Modern Analog and Digital Communication)	PO 1	PO 2	PO 3	PO 4	PO 5	PO- 6	PO 7	PO 8	PO-9	PO-10	PO-11	PO-12	Average
CO1	3	1	2	2	2	1	1	1	1	2	1	2	1.58
CO2	2	3	2	2	2	1	1	1	1	2	1	2	1.67
CO3	3	3	3	2	2	2	2	1	2	2	1	1	2.00
CO4	2	2	3	3	2	1	1	2	1	2	1	2	1.83
CO5	3	3	3	2	3	1	1	1	1	2	2	2	2.00
Average	2.6	2.4	2.6	2.2	2.2	1.2	1.2	1.2	1.2	2	1.2	1.8	

Satellite Communication

COURSE CODE: 18B1WEC841 COURSE

CREDITS: 3 CORE/ELECTIVE: ELECTIVE

L-T-P: 3-0-0

Pre-requisite: Basic knowledge of communications Course Objectives:

1. To acquire good knowledge about the components of a satellite communication system.
2. To analyze different methods of satellite access and the applications of satellites.

Course Outcomes:

S.No.	Course Outcomes	Level of Attainment
CO-1	To obtain basic knowledge of satellite communication principles.	Familiarity
CO-2	To have a thorough understanding of orbital mechanics and launches for the satellite communication.	Familiarity
CO-3	To understand the basic knowledge of link design of a satellite system.	Assessment
CO-4	To provide better understanding of multiple access systems and earth station technology.	Assessment
CO-5	To prepare students with knowledge in satellite navigation and GPS and satellite packet communications.	Usage

Course Contents:

Unit	Contents	Lectures required
1	Introduction : Origin of Satellite Communication, Historical Back-ground, Basic Concepts of Satellite Communication, Frequency allocations for Satellite Services, Applications, Future Trends of Satellite Communication.	2
2	Orbital mechanics and launchers: Kepler's laws, Newton's law, Orbital Mechanics, Look Angle determination, Orbital perturbations, Orbit determination, launches and launch vehicles, Orbital effects in communication systems performance.	7
3	Satellite systems: Attitude and orbit control system, telemetry, tracking, Command and monitoring, power systems, communication subsystems, Satellite antenna Equipment reliability and Space qualification.	6
4	Earth station technology and Link design: Introduction, Transmitters, Receivers, Antennas, Tracking systems, Terrestrial interface, Primary power test methods. Basic transmission theory, system noise temperature and G/T ratio, Design of down links, up link design, Design of satellite links for specified C/N, System design example.	6
5	Multiple Access: Frequency Division Multiple Access (FDMA) – Intermodulation Calculation of C/N, Time Division Multiple Access (TDMA) – Frame Structure, Burst Structure, Satellite Switched TDMA, On-board Processing, Demand Assignment Multiple Access (DAMA) — Types of Demand Assignment, Characteristics, CDMA Spread Spectrum Transmission and Reception.	9
6	Low earth orbit and geo-stationary satellite systems: Orbit consideration, coverage and frequency considerations, Delay & Throughput considerations, System considerations, Operational NGSO constellation Designs	6
7	Satellite navigation and the global positioning system: Radio and Satellite Navigation, GPS Position Location principles, GPS Receivers and codes, Satellite signal acquisition, GPS Navigation Message, GPS signal levels, GPS receiver operation, GPS C/A code accuracy, Differential GPS.	6
Total lectures		42

Suggested Text Book(s):

1. Timothy Pratt, Charles Bostian and Jeremy Allnutt, "Satellite Communications", 2nd Edition , John Wiley & Sons, 2002.
2. Dennis Roddy, "Satellite Communication", 4th Edition, Mc Graw Hill International, 2006.

Suggested Reference Book(s):

1. M.Richharia, "Satellite Communication Systems-Design Principles", 1st Edition, Palgrave, Macmillan 2003.
2. Wilbur L. Pritchard, Robert A Nelson and Henri G.Suyderhoud, "Satellite Communications Engineering", 2nd Edition, Pearson Publications, 2003.

Other useful resource(s):

Link to NPTEL course contents: https://nptel.ac.in/syllabus/117105131/

Evaluation Scheme:

S. No	Exam	Marks	Duration	Coverage / Scope of Examination
1	T-1	15	1 Hour.	Syllabus covered upto T-1
2	T-2	25	1.5 Hours	Syllabus covered upto T-2
3.	T-3	35	2 Hours	Entire Syllabus
4.	Teaching Assessment	25	Entire Semester	Assignment (2) - 10 Quizzes (2) - 10 Attendance - 5

Course Outcomes (COs) contribution to the Programme Outcomes (POs)

Course outcomes (Satellite Communications)	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	Average
CO-1	2	2	2	2	2	2	1	1	1	2	1	2	1.7
CO-2	2	3	2	3	2	2	2	1	1	2	1	3	2.0
CO-3	3	3	3	3	3	2	1	1	2	2	2	2	2.3
CO-4	2	2	2	2	2	3	2	1	1	3	2	2	2.0
CO-5	3	2	3	2	2	2	1	1	1	2	1	2	1.8
Average	2.4	2.4	2.4	2.4	2.2	2.2	1.4	1.0	1.2	2.2	4	2.20	

Digital Electronics and Logic Design

COURSE CODE: 18B11EC312

COURSE CREDITS: 4

CORE/ELECTIVE: CORE

L-T-P: 3-1-0

Pre-requisite: None

Course Objectives:

1. To understand the fundamental characteristics of digital logic levels.
2. To apply the knowledge to understand digital electronics circuits.

Course Outcomes:

S. No.	Course Outcomes	Level of Attainment
CO1	Have a thorough understanding of the fundamental concepts and techniques used in digital electronics.	Familiarity
CO2	To understand and examine the structure of various number systems and its application in digital design.	Familiarity
CO3	The ability to understand, analyze and design various Combinational and sequential circuits..	Usage
CO4	Ability to identify basic requirements for a design application and propose a cost effective solution.	Usage
CO5	The ability to identify and prevent various hazards and timing problems in a digital design	Assessment
CO6	To develop skill to build, and troubleshoot digital circuits.	Assessment

Course Contents:

Unit	Contents	Lectures required
1	Fundamentals of Digital Systems and logic families: Digital signals, digital circuits, AND, OR, NOT, NAND, NOR and Exclusive-OR operations, Boolean algebra, examples of IC gates, number systems-binary, signed binary, octal hexadecimal number, binary arithmetic, one's and two's complements arithmetic, codes, error detecting and correcting codes, characteristics of digital lCs, digital logic families, TTL, Schottky TTL and CMOS logic, interfacing CMOS and TTL, Tri-state logic.	11

2	Combinational Digital Circuits: Standard representation for logic functions, K-map representation, simplification of logic functions using K-map, minimization of logical functions. Don't care conditions, Multiplexer, De-Multiplexer/Decoders, Adders, Subtractors, BCD arithmetic, carry look ahead adder, serial adder, digital comparator, parity checker/generator, code converters, priority encoders, decoders/drivers for display devices.	10
3	Sequential circuits and systems: A 1-bit memory, the circuit properties of Bistable latch, the clocked SR flip flop, J- K-T and D types flipflops, applications of flipflops, shift registers, applications of shift registers, serial to parallel converter, parallel to serial converter, ring counter, sequence generator, ripple(Asynchronous) counters, synchronous counters, counters design using flip flops, special counter IC's, asynchronous sequential counters, applications of counters. Finite state machines, Design of synchronous FSM.	14
4	A/D and D/A Converters: Digital to analogue converters: weighted resistor/converter, R-2R Ladder D/A converter, specifications for D/A converters, sample and hold circuit, analogue to digital converters: quantization and encoding, parallel comparator A/D converter, successive approximation A/D converter, counting A/D converter, dual slope A/D converter, A/D converter using voltage to frequency and voltage to time conversion, specifications of A/D converters.	4
5	Programmable logic devices: Commonly used memory chips, ROM as a PLD, Programmable logic array, Programmable array logic, complex Programmable logic devices (CPLDS), Field Programmable Gate Array (FPGA).	3
Total lectures		42

Suggested Text Book(s):

1. A. Kumar, "Fundamentals of Digital Circuits", 4th Edition, Prentice Hall India, 2016.
2. M. M. Mano, Michael D Ciletti, "Digital Logic and Computer Design", 4th Edition, Pearson Education India, 2008.
3. R. P. Jain, "Modern Digital Electronics", 4th Edition, McGraw Hill Education, 2010.

Other useful resource(s):

1. https://onlinecourses.nptel.ac.in/noc18_ee33/ (Prof. Santanu Chattopadhyay, IIT Kharagpur)
2. https://nptel.ac.in/courses/117106086/ (Prof. S. Srinivasan, IIT Madras)

Evaluation Scheme:

S. No.	Exam	Marks	Duration	Coverage / Scope of Examination
1	T-1	15	1 Hour.	Syllabus covered upto T-1
2	T-2	25	1.5 Hours	Syllabus covered upto T-2
3.	T-3	35	2 Hours	Entire Syllabus
4.	Teaching Assessment	25	Entire Semester	Assignment (2) - 10 Quizzes (2) - 10 Attendance - 5

Course Outcomes (COs) contribution to the Programme Outcomes (POs)

Course Outcomes (Digital Electronics and Logic Design)	PO 1	PO 2	PO 3	PO 4	PO 5	PO-6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	Average
CO1	2	2	2	2	3	2	1	1	3	2	2	3	2.08
CO2	3	3	2	3	3	3	3	1	1	3	3	3	2.42
CO3	3	3	3	3	3	3	2	1	2	3	2	3	2.50
CO4	3	2	3	1	2	3	1	3	1	2	3	3	2.17
CO5	3	3	2	3	3	3	1	2	1	3	2	3	2.42
CO6	2	3	3	3	3	2	2	2	3	3	1	2	2.42
Average	2.67	2.67	2.50	2.50	2.83	2.67	1.66	1.66	1.83	2.67	2.17	2.83	

Wireless and Data Communication

COURSE CODE: 18B11EC611

COURSE CREDITS: 3

CORE/ELECTIVE: CORE

: 3-0-0

Pre-requisite: None

Course Objectives:

1. To understand the fundamentals of wireless and data communication networks.
2. To allow the students to learn network architecture and protocols of trending wireless networks.

Course Outcomes:

S. No.	Course Outcomes	Level of Attainment
CO-1	Understand the basics of wireless communication system and various wireless standards.	Familiarity
CO-2	Have the basic knowledge of computer networks and its applications in communication engineering.	Familiarity
CO-3	Understand the behavior of wireless channel.	Usage
CO-4	Have the knowledge of data sharing and their protocols.	Usage
CO-5	Brief the recent protocols and standards of various communication networks.	Assessment
CO-6	Get familiar with the recent wireless communication systems.	Assessment

Course Contents:

Unit	Contents	Lectures required
1	Review of Wireless Communication: Introduction to Wireless Communication, Basic building blocks of wireless system: source coding & channel coding, base band & band pass signal representation; 1G, 2G, 2.5G, 3G, 4G and 5G wireless standards and their Comparison; Multiple Access techniques: TDMA, FDMA, CDMA, OFDMA.	6
2	Wireless Channel: Linear Time Varying System; Path loss model; Multipath Propagation; Doppler Shift; Parameters of Wireless Multipath Channel; Small-scale and large-scale fading; Shadowing, Types of Fading: flat fading, frequency selective fading, slow fading and fast fading; Capacity of wireless channel: Capacity of AWGN, Flat Fading and Frequency Selective Channels.	10
3	Data Communication: OSI vs TCP/IP model; Wired vs Wireless; Circuit switching/ Packet switching; Flow control and error control; CRC; Connection oriented/connection less transmission; Bit stuffing.	7
4	MAC, Network and transport layer protocols: Dynamic multiple access methods: ALOHA, slotted ALOHA, CSMA/CD etc; Routing algorithms: DSDV, LSR, AODV; Broadcasting methods: flooding, spanning tree, multicasting; UDP, TCP, IP, IPv4, IPv6, QoS.	8
5	Wireless Networks: Introduction to WiFi; 802.11, 802.11a and 802.11 b Wireless LANs; Frame structure; Modes of operation; Data rates; Power management; Handoff strategies, Medium access control etc. Bluetooth networks: Piconet, scatternet, frame structure, data rates; synchronous and asynchronous services, power saving etc	8
6	Recent Trends: Introduction to WiMAX and ZigBee Networks; Software Defined Radio; UWB Radio; Wireless Adhoc Network and Mobile Portability; Security issues and challenges in a Wireless network.	3

Total lectures	42

Suggested Text Book(s):

1. T.S. Rappaport, "Wireless Communication", 2nd Edition, Prentice Hall., 2010.
2. A. Tanenbaum, "Computer Networks", 5th Edition, Prentice Hall, 2011.
3. Bahrouz Forouzan, "Data communication & Networking," 5th Edition, McGraw Hill, 2017.

Suggested Reference Book(s):

1. William Stallings, "Data and Computer Communications," 10th Edition, Pearson.,2013.

Other useful resource(s):

Link to NPTEL course contents:

1. https://nptel.ac.in/courses/117102062/36
2. https://nptel.ac.in/courses/106105082/31

Evaluation Scheme:

S. No	Exam	Marks	Duration	Coverage / Scope of Examination
1	T-1	15	1 Hour.	Syllabus covered upto T-1
2	T-2	25	1.5 Hours	Syllabus covered upto T-2
3.	T-3	35	2 Hours	Entire Syllabus
4.	Teaching Assessment	25	Entire Semester	Assignment (2) - 10 Quizzes (2) - 10 Attendance - 5

Course Outcomes (COs) contribution to the Programme Outcomes (POs)

Course outcomes (Wireless and Data Communication)	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	Average
CO-1	3	2	1	3	1	1	1	1	1	2	1	2	1.58
CO-2	3	3	1	3	2	1	1	3	1	2	1	2	1.92
CO-3	3	3	2	3	2	1	2	3	1	2	1	2	2
CO-4	3	3	3	3	2	1	2	3	1	2	1	2	2.17
CO-5	3	3	3	3	3	1	2	3	2	2	1	2	2.33
CO-6	3	3	3	3	3	1	3	3	3	2	3	2	2.67
Average	3	3	2.17	3	2.17	1	1.83	2.67	1.5	2	1.33	2	