Fifth Semester					
Group	**Paper Code**	**Paper**	**L**	**P**	**Credits**
Theory Papers					
HS/MS	HS-301	Economics for Engineers	2		2
PC	ECC-303	Digital Signal Processing	4		4
PC	ECC-305	Microelectronics	3		3
PC	EEC-307	Introduction to Control Systems	3		3
PC	ECC-309	Transmission Lines, Waveguides and Antenna Design	4		4
PC	ECC-311	Data Communication and Networking	4		4
Practical / Viva Voce					
PC	ECC-351	Digital Signal Processing Lab		2	1
PC	ECC-353	Microelectronics Lab		2	1
PC	EEC-355	Introduction to Control Systems Lab		2	1
PC	ECC-357	Transmission Lines, Waveguides and Antenna Design Lab		2	1
PC	ECC-359	Data Communication and Networking Lab		2	1
PC / Internship	ES-361	Summer Training Report - 1 *			1
Total		_	**20**	**10**	**26**

***NUES:**Comprehensive evaluation of the Summer Training Report – 1 (after 4th Semester) shall be done by the committee of teachers, constituted by the Academic Programme Committee, out of 100. The training shall be of 4 to 6 weeks duration. The training can be under the mentorship of a teacher of the institute.

Sixth Semester					
Group	**Paper Code**	**Paper**	**L**	**P**	**Credits**
Theory Papers					
HS/MS	MS-302	Principles of Management for Engineers	3		3
HS/MS	HS-304	Universal Human Values*	1		1
PCE		Programme Core Elective Paper (PCE –1)			4
PCE		Programme Core Elective Paper (PCE – 2)			4
PCE		Programme Core Elective Paper (PCE – 3)			4
EAE / OAE		Emerging Area/Open Area Elective Paper (EAE – 1 /OAE – 1)			4
EAE / OAE		Emerging Area/Open Area Elective Paper (EAE – 2 /OAE – 2)			4
Practical / Viva Voce					
HS/MS	HS-352	NSS / NCC / Cultural Clubs / Technical Society / Technical Club**			2
Total					**26**

***NUES:**All examinations to be conducted by the concerned teacher as specified in the detailed syllabus of the paper.

****NUES:** Comprehensive evaluation of the students by the concerned coordinator of NCC / NSS / Cultural Clubs / Technical Society / Technical Clubs, out of 100 as per the evaluation schemes worked out by these activity societies, organizations; the faculty co-ordinators shall be responsible for the evaluation of the same. These activities shall start from the 1st semester and the evaluation shall be conducted at the end of the 6th semester for students admitted in the first semester. Students admitted in the 2nd year (3rd semester) as lateral entry shall be evaluated on the basis their performance, by the faculty co-ordinator for the period of 3rd semester to 6th semester only.

Machine Learning Lab	L	P	C
		2	1

Discipline(s) / EAE / OAE	Semester	Group	Sub-group	Paper Code
ECE	6	PCE	PCE-3	ECE-350P
EAE	6	MLDA-EAE	MLDA-EAE-2C	ML-342P
CSE/IT/CST/ITE	7	PCE	PCE-5	CIE-421P
CSE-AIML	7	PC	PC	ML-407P
EAE	7	AIML-EAE	AIML-EAE-3	ML-407P

Marking Scheme:

1. Teachers Continuous Evaluation: 40 marks
2. Term end Theory Examinations: 60 marks

Instructions:

1. The course objectives and course outcomes are identical to that of (Machine Learning) as this is the practical component of the corresponding theory paper.
2. The practical list shall be notified by the teacher in the first week of the class commencement under intimation to the office of the Head of Department / Institution in which the paper is being offered from the list of practicals below. Atleast 10 experiments must be performed by the students, they may be asked to do more. Atleast 5 experiments must be from the given list.

1. Introduction to JUPYTER IDE and its libraries Pandas and NumPy
2. Program to demonstrate Simple Linear Regression
3. Program to demonstrate Logistic Regression
4. Program to demonstrate Decision Tree – ID3 Algorithm
5. Program to demonstrate k-Nearest Neighbor flowers classification
6. Program to demonstrate Naïve- Bayes Classifier
7. Program to demonstrate PCA and LDA on Iris dataset
8. Program to demonstrate DBSCAN clustering algorithm
9. Program to demonstrate K-Medoid clustering algorithm
10. Program to demonstrate K-Means Clustering Algorithm on Handwritten Dataset

Machine Learning	L	P	C
	3		3

Discipline(s) / EAE / OAE	Semester	Group	Sub-group	Paper Code
ECE	6	PCE	PCE-3	ECE-350T
EAE	6	MLDA-EAE	MLDA-EAE-2C	ML-342T
CSE/IT/CST/ITE	7	PCE	PCE-5	CIE-421T
CSE-AIML	7	PC	PC	ML-407T
EAE	7	AIML-EAE	AIML-EAE-3	ML-407T

Marking Scheme:

1. Teachers Continuous Evaluation: 25 marks
2. Term end Theory Examinations: 75 marks

Instructions for paper setter:

1. There should be 9 questions in the term end examinations question paper.
2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type question of total 15 marks.
3. Apart from question 1 which is compulsory, rest of the paper shall consist of 4 units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain upto 5 sub-parts / sub-questions. Each Unit shall have a marks weightage of 15.
4. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook.
5. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.

Course Objectives :

1.	To understand the need of machine learning
2.	To learn about regression and feature selection
3.	To understand about classification algorithms
4.	To learn clustering algorithms

Course Outcomes (CO)

CO 1	To formulate machine learning problems
CO 2	Learn about regression and feature selection techniques
CO 3	Apply machine learning techniques such as classification to practical applications
CO 4	Apply clustering algorithms

Course Outcomes (CO) to Programme Outcomes (PO) mapping (scale 1: low, 2: Medium, 3: High)

	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12
CO 1	3	3	3	3	3	2	2	-	-	-	-	2
CO 2	3	3	3	3	3	2	2	-	-	-	-	2
CO 3	3	3	3	3	3	2	2	-	-	-	-	2
CO 4	3	3	3	3	3	2	2	-	-	-	-	2

UNIT-I

Introduction: Machine learning, terminologies in machine learning, Perspectives and issues in machine learning, application of Machine learning, Types of machine learning: supervised, unsupervised, semi-supervised learning. Review of probability, Basic Linear Algebra in Machine Learning Techniques, Dataset and its types,Data preprocessing, Bias and Variance in Machine learning , Function approximation, Overfitting

UNIT-II

Regression Analysis in Machine Learning: Introduction to regression and its terminologies,Types of regression,Logistic Regression

Simple Linear regression: Introduction to Simple Linear Regression and its assumption, Simple Linear Regression Model Building,Ordinary Least square estimation, Properties of the least-squares estimators and the fitted regression model, Interval estimation in simple linear regression , Residuals
Multiple Linear Regression:Multiple linear regression model and its assumption, **Interpret Multiple Linear Regression Output(R-Square, Standard error, F, Significance F, Cofficient P values), Access the fit of multiple linear regression model (**R squared, Standard error)
Feature Selection and Dimensionality Reduction: PCA, LDA, ICA

UNIT-III

Introduction to Classification and Classification Algorithms: What is Classification? General Approach to Classification, k-Nearest Neighbor Algorithm, Random Forests, Fuzzy Set Approaches
Support Vector Machine: Introduction, Types of support vector kernel – (Linear kernel, polynomial kernel, and Gaussiankernel), Hyperplane – (Decision surface), Properties of SVM, and Issues in SVM.
Decision Trees: Decision tree learning algorithm,ID-3algorithm, Inductive bias, Entropy and information theory, Information gain,Issues in Decision tree learning.
Bayesian Learning - Bayes theorem, Concept learning, Bayes Optimal Classifier, Naïve Bayes classifier, Bayesian belief networks, EM algorithm
Ensemble Methods: Bagging, Boosting and AdaBoost and XBoost,
Classification Model Evaluation and Selection: Sensitivity, Specificity, Positive Predictive Value, Negative Predictive Value, Lift Curves and Gain Curves, ROC Curves, Misclassification Cost Adjustment to Reflect Real-World Concerns, Decision Cost/Benefit Analysis

UNIT – IV

Introduction to Cluster Analysis and Clustering Methods: The Clustering Task and the Requirements for Cluster Analysis , Overview of Some Basic Clustering Methods:-k-Means Clustering, k-Medoids Clustering, Density-Based Clustering: DBSCAN - Density-Based Clustering Based on Connected Regions with High Density, Gaussian Mixture Model algorithm , Balance Iterative Reducing and Clustering using Hierarchies (BIRCH) , Affinity Propagation clustering algorithm,Mean-Shift clustering algorithm, ordering Points to Identify the Clustering Structure (OPTICS) algorithm, Agglomerative Hierarchy clustering algorithm, **Divisive Hierarchical** , Measuring Clustering Goodness

Textbook(s):

1. Tom M. Mitchell, “Machine Learning”, McGraw-Hill Education (India) Private Limited, 2013.
2. M. Gopal, “Applied Machine Learning”, McGraw Hill Education

References:
1. C. M. BISHOP (2006), “Pattern Recognition and Machine Learning”, Springer-Verlag New York, 1st Edition
2. R. O. Duda, P. E. Hart, D. G. Stork (2000), Pattern Classification, Wiley-Blackwell, 2nd Edition

Mobile Computing Lab	L	P	C
		2	1

Discipline(s) / EAE / OAE	Semester	Group	Sub-group	Paper Code
CSE	6	PCE	PCE-3	CIE-368P
ECE	6	PCE	PCE-1	ECE-316P
EAE	7	WMC-EAE	WMC-EAE-3B	WMC-455P

Marking Scheme:

1. Teachers Continuous Evaluation: 40 marks
2. Term end Theory Examinations: 60 marks

Instructions:

1. The course objectives and course outcomes are identical to that of (Mobile Computing) as this is the practical component of the corresponding theory paper.
2. The practical list shall be notified by the teacher in the first week of the class commencement under intimation to the office of the Head of Department / Institution in which the paper is being offered from the list of practicals below. Atleast 10 experiments must be performed by the students, they may be asked to do more. Atleast 5 experiments must be from the given list.

1. Write a program to create a card and print "Hello! WML" in <p> tag.
2. Write a program to create and execute external links in WML.
3. Write a program to create multiple cards in WML and perform navigation between them using do tags.
4. Write a program to show images (.wbmp file) in WML page.
5. Write a program to create a table in WML.
6. Write a program to create a form in one card and show entered/selected data in second card in WML. Use input, select, option and do tags.
7. Write a program to show the usage of onpick and ontimer events in WML page.
8. Write a simple WML script to set and show the value of a variable.
9. Write a WML script to input a number and show the square of that number.
10. Write a WML script to input two numbers and show the sum.
11. Write a WML script and program to create a calculator.
12. Develop an android app which displays “Hello, welcome to Android Lab” message.
13. Using Android, create a login Activity which asks “username” and “password” from user. Display the welcome message if the username and password are valid.

Mobile Computing	L	P	C
	3		3

Discipline(s) / EAE / OAE	Semester	Group	Sub-group	Paper Code
CSE	6	PCE	PCE-3	CIE-368T
ECE	6	PCE	PCE-1	ECE-316T
EAE	7	WMC-EAE	WMC-EAE-3B	WMC-455T

Marking Scheme:

1. Teachers Continuous Evaluation: 25 marks
2. Term end Theory Examinations: 75 marks

Instructions for paper setter:

1. There should be 9 questions in the term end examinations question paper.
2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type question of total 15 marks.
3. Apart from question 1 which is compulsory, rest of the paper shall consist of 4 units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain upto 5 sub-parts / sub-questions. Each Unit shall have a marks weightage of 15.
4. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook.
5. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.

Course Objectives :

1.	To impart the knowledge of mobile physical layer and mobile computing architecture.
2.	To impart the fundamentals of mobile data link layer and Bluetooth.
3.	To impart the knowledge of mobile IP network layer and mobile transport layer.
4.	To impart the knowledge related to the usage of wireless devices and operating systems and the concepts of mobile application languages.

Course Outcomes (CO)

CO 1	Understand and illustrate the concepts of mobile physical layer and mobile computing architecture.
CO 2	Integrate the knowledge of mobile data link layer and Bluetooth.
CO 3	Analyse the features of mobile IP network layer and mobile transport layer.
CO 4	Outline the usage of wireless devices and operating systems and summarizing the concepts of mobile application languages.

Course Outcomes (CO) to Programme Outcomes (PO) mapping (scale 1: low, 2: Medium, 3: High)

	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12
CO 1	3	2	2	2	2	1	1	-	1	1	-	3
CO 2	3	2	2	2	2	1	1	-	1	1	-	3
CO 3	3	2	2	2	2	1	1	-	1	1	-	3
CO 4	3	3	2	2	3	1	1	-	1	1	-	3

UNIT-I

Mobile Physical layer: Review of generation of mobile services, overview of wireless telephony, cellular concept, GSM: air-interface, channel structure, location management: HLR-VLR, hierarchical, handoffs, channel allocation in cellular systems, CDMA, GPRS.
Mobile computing Architecture: issues in mobile computing, three tier architecture for mobile computing, design considerations, Mobile file systems, Mobile databases. WAP: Architecture, protocol stack, Data gram protocol, Wireless transport layer security, Wireless transaction protocol, wireless session protocol, application environment, and applications.

UNIT-II

Mobile Data link layer: Wireless LAN over view, IEEE 802.11, Motivation for a specialized MAC, Near & far terminals, Multiple access techniques for wireless LANs such as collision avoidance, polling, Inhibit sense, spread spectrum, CDMA, LAN system architecture, protocol architecture, physical layer MAC layer and management, Hiper LAN.
Blue Tooth: IEEE 802.15 Blue tooth User scenarios, physical, MAC layer and link management.
Local Area Wireless systems: WPABX, IrDA, ZigBee, RFID, WiMax

UNIT-III

MOBILE IP Network Layer: IP and Mobile IP Network Layer- Packet delivery and Handover Management- Location Management- Registration- Tunnelling and Encapsulation-Route Optimization- Dynamic Host Configuration Protocol, Ad Hoc networks, localization, MAC issues, Routing protocols, global state routing (GSR), Destination sequenced distance vector routing (DSDV), Dynamic source routing (DSR), Ad Hoc on demand distance vector routing (AODV), VoIP –IPSec,
Mobile Transport Layer: Traditional TCP/IP, Transport Layer Protocols-Indirect, Snooping, Mobile TCP

UNIT – IV

Support for Mobility: Data bases, data hoarding, Data dissemination, UA Prof and Caching, Service discovery, Data management issues, data replication for mobile computers, adaptive clustering for mobile wireless networks, Mobile devices and File systems, Data Synchronization, Sync ML.
Introduction to Wireless Devices and Operating systems: Palm OS, Windows CE, Symbion OS, Android, Mobile Agents. Introduction to Mobile application languages and tool kits.

Textbook(s):

1. J. Schiller, “Mobile Communications”, 2nd edition, Pearson, 2011.
2. Raj Kamal “Mobile Computing” Oxford Higher Education, Second Edition, 2012.
3. Dharam Prakash Agrawal and Qing-An Zeng, “Introduction to Wireless and Mobile Systems” 3rd Edition, Cengage learning 2013.

References:

1. Asoke K Talukder, Hasan Ahmed,Roopa R Yavagal “Mobile Computing”, Tata McGraw Hill.
2. Pei Zheng, Larry L. Peterson, Bruce S. Davie, Adrian Farrell “Wireless Networking Complete” Morgan Kaufmann Series in Networking , 2009
3. Vijay K Garg “Wireless Communications & Networking” Morgan Kaufmann Series, 2010
4. M. V. D. Heijden, M. Taylor, Understanding WAP, Artech House.
5. Charles Perkins, Mobile IP, Addison Wesley.
6. Charles Perkins, Ad hoc Networks, Addison Wesley.
7. Uwe Hansmann, Lothar Merk, Martin S. Nicklous, Thomas Stober, “Principles of Mobile Computing”, Springer.
8. Evaggelia Pitoura and George Samarus, “Data Management for Mobile Computing”, Kluwer Academic Press, 1998
9. V. Jeyasri Arokiamary, “Mobile Computing”, Technical Publications

Optical Communication Systems and Networks Lab	L	P	C
		2	1

Discipline(s) / EAE / OAE	Semester	Group	Sub-group	Paper Code
ECE	6	PCE	PCE-2	ECE-326P

Marking Scheme:
1. Teachers Continuous Evaluation: 40 marks
2. Term end Theory Examinations: 60 marks

Instructions:
1. The course objectives and course outcomes are identical to that of (Optical Communication Systems and Networks) as this is the practical component of the corresponding theory paper.
2. The practical list shall be notified by the teacher in the first week of the class commencement under intimation to the office of the Head of Department / Institution in which the paper is being offered from the list of practicals below. Atleast 10 experiments must be performed by the students, they may be asked to do more. Atleast 5 experiments must be from the given list.

1. To setup a Fiber Optic Analog Link and study Intensity modulation Technique using analog input signal.
2. To setup a Fiber Optic Analog Link, study the frequency response, and determine the analog bandwidth of the link.
3. To setup a simple Fiber Optic Voice Link.
4. To setup a Fiber Optic Digital Link and study Intensity modulation Technique using digital input signal.
5. To setup a Fiber Optic Digital Link using a LED source and determine the maximum bit rate that can be transmitted on the digital link.
6. To study the Time Division multiplexing technique over a Fiber Optic Link.
7. To measure the Propagation Loss in Optical Fiber and determine the attenuation coefficient.
8. To measure the Bending Loss in Optical Fiber.
9. To measure the Numerical Aperture of the Optical Fiber.
10. To study the I-V characteristic of Light Emmiting Diode (LED).
11. To study the P-I characteristic of a LASER Diode.
12. To study and plot the characteristics of a Photo Detector.

Optical Communication Systems and Networks	L	P	C
	3		3

Discipline(s) / EAE / OAE	Semester	Group	Sub-group	Paper Code
ECE	6	PCE	PCE-2	ECE-326T

Marking Scheme:

1. Teachers Continuous Evaluation: 25 marks
2. Term end Theory Examinations: 75 marks

Instructions for paper setter:

1. There should be 9 questions in the term end examinations question paper.
2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type question of total 15 marks.
3. Apart from question 1 which is compulsory, rest of the paper shall consist of 4 units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain upto 5 sub-parts / sub-questions. Each Unit shall have a marks weightage of 15.
4. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook.
5. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.

Course Objectives :

1.	To impart the Knoledge of optical communication and propagation of light through physical medium.
2.	To impart the knowledge about optical fibers, propagation of light through them and signal degradation during signal propagation through optical fibers.
3.	Let the students understand about the types, construction, working and characteristics of various optical sources.
4.	Let the students know about the types, construction, working of various optical detectors and also know about basic optical receiver. Students should also know about basic optical networks.

Course Outcomes (CO)

CO 1	To understand the optical communication and propagation of light through physical medium.
CO 2	To understand various types of optical fibers, propagation of light through them and able to analyse signal degradation in optical fibers.
CO 3	To understand various optical sources and use them in optical transmitting systems.
CO 4	To understand various optical detectors and apply them in optical receivers and Analyze various optical networks.

Course Outcomes (CO) to Programme Outcomes (PO) mapping (scale 1: low, 2: Medium, 3: High)

	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12
CO 1	3	3	2	2	2	2	1	-	1	2	1	2
CO 2	3	3	2	2	2	2	1	-	1	2	1	2
CO 3	3	3	2	2	2	2	1	-	1	2	1	2
CO 4	3	3	2	2	2	2	1	-	1	2	1	2

UNIT I

Introduction: Optical spectral bands and windows, Basic optical communication system, Advantages of optical communication systems.

Optical Fiber Waveguides & Fabrication: Nature of light, Ray theory transmission of light, Electromagnetic mode theory for optical propogation, Mode theory for circular waveguides, Optical fiber modes, Fiber materials, Fabrication and mechanical properties, Fiber optic cables.

UNIT II

Optical fiber Structures and Propagation: Classifications of optical fibers, Step-index fibers, Graded-index fibers, Single-mode fibers, Multimode fibers, Wave propagation in all these fibers, Types of single-mode fibers.
Signal Degradation in Optical Fibers:
Attenuation – Absorption, Scattering, Bending loss.
Signal Distortion – Intermodal dispersion, Chromatic dispersion, Dispersion in all types of fibers. Dispersion modified single-mode fibers.

UNIT III

Optical Sources:
LEDs – Basic concepts of radiation, LED Structures, LED Configurations, Types of LEDs, LED Power & Efficiency, Modulation of an LED, LED Characteristics.
Lasers – Basic Concepts(Types of emission, Population inversion, Laser oscillations, Lasing etc.), Laser modes and threshold conditions, Laser diode rate equations, Laser structures and radiation patterns, External quantum efficiency, Types of Lasers, Modulation of Laser, Laser characteristics.
Basic optical transmitter.

UNIT IV

Optical Detectors: Basic concepts(Optical detection principle, Absorption, Quantum efficiency & Responsivity, etc.), p-n Photodiode, p-i-n Photodiode, Avalanche Photodiode, Detector Response time, Photodetector noise, Multiplication factor, Phototransistors, Basic Optical receiver.
Optical Networks: Network concepts, Network topologies, SONET/SDH, High speed lightwave links, WDM Networks, Optical TDM, Subcarrier multiplexing.

Textbook(s):
1. John M. Senior, “Optical Fiber Communications”, Pearson, 3rd Edition, 2010.
2. Gerd Keiser, “Optical Fiber Communications”, Tata McGraw Hill, 4th edition, 2008.

Reference Books:
1. D.K.Mynbeav & L.L. Scheiner, “Fiber optic Communication Technology”, Pearson Education, 2001.
2. J. Gowar, “Optical Communication System”, PHI, 2nd edition, 1993.
3. G. P. Agrawal, “Fiber optic Communication Systems”, John Wiley & sons, New York, 1992.
4. R.P.Khare, "Fiber Optics and Opto Electronics", Oxford University Press, 2004.

Principles of Management for Engineers	L	P	C
	3		3

Discipline(s) / EAE / OAE	Semester	Group	Sub-group	Paper Code
All	6	HS/MS	MS	MS-302

Marking Scheme:

1. Teachers Continuous Evaluation: 25 marks
2. Term end Theory Examinations: 75 marks

Instructions for paper setter:

1. There should be 9 questions in the term end examinations question paper.
2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type question of total 15 marks.
3. Apart from question 1 which is compulsory, rest of the paper shall consist of 4 units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain upto 5 sub-parts / sub-questions. Each Unit shall have a marks weightage of 15.
4. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook.
5. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.

Course Objectives :

1.	To describe the functions, roles and skills of managers and illustrate how the manager's job is evolving.
2.	To evaluate approaches to goal setting, planning and organizing in a variety of circumstances.
3.	To evaluate contemporary approaches for staffing and leading in an organization
4.	To analyze contemporary issues in controlling for measuring organizational performance.

Course Outcomes (CO)

CO 1	Examine the relevance of the political, legal, ethical, economic andcultural environments in global business
CO 2	Evaluate approaches to goal setting, planning and organizing in a variety of circumstances.
CO 3	Evaluate contemporary approaches for staffing and leading in an organization
CO 4	Analyze contemporary issues in controlling for measuring organizational performance.

Course Outcomes (CO) to Programme Outcomes (PO) mapping (scale 1: low, 2: Medium, 3: High)

	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12
CO 1	2	2	1	2	-	2	-	-	1	2	3	2
CO 2	2	2	1	2	-	2	-	-	1	2	3	2
CO 3	2	2	1	2	-	2	-	-	1	2	3	2
CO 4	2	2	1	2	-	2	-	-	1	2	3	2

UNIT-I

Introduction to Managers and Management: Management an Overview: Introduction, Definition ofManagement, Role of Management, Functions of Managers,Levels of Management, Management Skills andOrganizational Hierarchy, Social and EthicalResponsibilities of Management: Arguments for and againstSocial Responsibilities of Business, Social Stakeholders,Measuring Social Responsiveness and Managerial Ethics,Omnipotent and Symbolic View, Characteristics andimportance of organizational culture, Relevance of political,legal, economic and Cultural environments to globalbusiness, Structures and techniques organizations use asthey go international .

UNIT-II

Planning: Nature & Purpose, Steps involved in Planning, Objectives, Setting Objectives, Process of Managing by Objectives, Strategies, Policies & Planning Premises, CompetitorIntelligence, Benchmarking, Forecasting, Decision-Making.

Directing: Scope, Human Factors, Creativity and Innovation,Harmonizing Objectives, Leadership, Types of Leadership,Directing, Managers as leaders, Early LeadershipTheories…Trait Theories, Behavioral Theories, ManagerialGrid, Contingency Theories of Leadership, Directing ...PathGoal Theory, contemporary views of Leadership, CrossCultural Leadership, Leadership Training, Substitutes ofLeadership

UNIT-III

Organizing: Organizing ,Benefits and Limitations-De-Centralization andDelegation of Authority, Authority versus Power,Mechanistic Versus Organic Organization ,CommonOrganizational Designs, Contemporary OrganizationalDesigns and Contingency Factors, The LearningOrganization Nature and Purpose, Formal and InformalOrganization, Organization Chart, Structure and Process,Departmentalization by difference strategies, Line and Staffauthority- Benefits and Limitations-De-Centralization andDelegation of Authority Versus, Staffing,Human ResourceInventory, Job Analysis , Job Description, Recruitment and

UNIT - IV

Controlling: Controlling, Introduction to Controlling System and processof Controlling, Requirements for effective control, Theplanning Contol link, The process of control, types ofcontrol The Budget as Control Technique, InformationTechnology in Controlling, Productivity, Problems andManagement, Control of Overall Performance, Direct andPreventive Control, Financial Controls, Tools formeasuring organizational Performance, Contemporaryissues in control Workplace concerns, employee theft,employee violence

Textbook(s):

1. Tripathi PC. Principles of management. Tata McGraw-Hill Education; 6th Edition 2017.

References:

1. Koontz H, Weihrich H. Essentials of management: an international, innovation, and leadershipperspective. McGraw-Hill Education; 10th Edition 2018.
2. Principles of Management Text and Cases, Pravin Durai , Pearson ,2015
3. Robbins, S.P. &Decenzo, David A. Fundamentals of Management,7th ed., Pearson, 2010
4. Robbins, S.P. & Coulter, Mary Management; 14 ed.,Pearson , 2009

Random Processes and Stochastic Systems Lab	L	P	C
		2	1

Discipline(s) / EAE / OAE	Semester	Group	Sub-group	Paper Code
ECE	6	PCE	PCE-2	ECE-334P
EAE	6	WMC-EAE	WMC-EAE-1B	WMC-334P

Marking Scheme:

1. Teachers Continuous Evaluation: 40 marks
2. Term end Theory Examinations: 60 marks

Instructions:

1. The course objectives and course outcomes are identical to that of (Random Processes and Stochastic Systems) as this is the practical component of the corresponding theory paper.
2. The practical list shall be notified by the teacher in the first week of the class commencement under intimation to the office of the Head of Department / Institution in which the paper is being offered from the list of practicals below. Atleast 10 experiments must be performed by the students, they may be asked to do more. Atleast 5 experiments must be from the given list.

1. Write a program to plot the Deterministic and Stochastic (Continuous) signals
2. Write a program to generate the random variables: a Uniform random variable, a Gaussian random variable, and a Rayleigh distributed random variable of appropriate length
3. Write a program to generate discrete random variable using Binomial and Bernoulli Distribution
4. Write a program to plot time properties of signals (Time shifting, time scaling and time reversing)
5. Write a program to plot the stochastic properties of signal (Mean, variance, auto correlation, cross correlation, auto covariance)
6. Write a program to generate samples of a zero-mean stationary Gaussian vector process on [0, T] using the FFT algorithm
7. Write a program to estimate the auto- or cross-covariance function of a stationary, ergodic process.
8. Write a program to provide an estimate of the cross covariance function of stationary processes X and Y, given one sample of each.
9. A probability class has N students enrolled. Write Program to compute the probability of at least two students have birthday on same day.
10. To simulate continuous time Markov chain for n × n state transition matrix Q, and initial state probabilities vector p0 of length n
11. To simulate Brownian motion stochastic process with vector t holding an ordered sequence of inspection times, alpha the scaling constant of a Brownian motion process such that the ith increment has variance $\alpha(t_i - t_{i-1})$.
12. To simulate Poisson process with lambda is the arrival rate of a Poisson process, t is a vector of "inspection times'

Random Processes and Stochastic Systems	L	P	C
	3		3

Discipline(s) / EAE / OAE	Semester	Group	Sub-group	Paper Code
ECE	6	PCE	PCE-2	ECE-334T
EAE	6	WMC-EAE	WMC-EAE-1B	WMC-334T

Marking Scheme:

1. Teachers Continuous Evaluation: 25 marks
2. Term end Theory Examinations: 75 marks

Instructions for paper setter:

1. There should be 9 questions in the term end examinations question paper.
2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type question of total 15 marks.
3. Apart from question 1 which is compulsory, rest of the paper shall consist of 4 units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain upto 5 sub-parts / sub-questions. Each Unit shall have a marks weightage of 15.
4. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook.
5. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.

Course Objectives :

1.	To impart the basic knowledge of random variable
2.	To impart the knowledge of both temporal and spectral characteristics of Random Process
3.	To familiarize the students with several stochastic processes specially Markov process ,Poisson process, and renewal processes
4.	To be acquainted with systems involving random signals.

Course Outcomes (CO)

CO 1	To evaluate the statistical properties of random variables and can handle probabilistic transformations.
CO 2	To understand the temporal and spectral characteristics of Random Process
CO 3	To understand the basic properties of the Markov process ,Poisson process, and renewal processes in general
CO 4	To understand how to estimate certain performance measures associated with aspects of a stochastic system.

Course Outcomes (CO) to Programme Outcomes (PO) mapping (scale 1: low, 2: Medium, 3: High)

	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12
CO 1	3	3	3	3	2	1	1	-	2	1	-	2
CO 2	3	3	3	3	2	1	1	-	2	1	-	2
CO 3	3	3	3	3	2	1	1	-	2	1	-	2
CO 4	3	3	3	3	2	1	1	-	2	1	-	2

UNIT I

Random Variable: Definition of a Random Variable, Conditions for a Function to be a Random Variable, Discrete and Continuous, Mixed Random Variable, Distribution and Density functions, Properties, Binomial, Poisson, Uniform, Gaussian, Exponential, Rayleigh, Conditional Distribution, Methods of defining Conditioning Event, Conditional Density, Properties. Distribution Function, Properties of Joint Distribution, Marginal Distribution Functions, Conditional Distribution and Density, Statistical Independence, Sum of Two Random Variables, Sum of Several Random Variables, Central Limit Theorem: Unequal Distribution, Equal Distributions.

UNIT II

Random Processes – Temporal Characteristics: The Random Process Concept, Classification of Processes, Deterministic and Nondeterministic Processes, Distribution and Density Functions, Concept of Stationarity and Statistical Independence. First-Order Stationary Processes, Second-order and Wide-Sense Stationarity, Nth-order and Strict-Sense Stationarity, Time Averages and Ergodicity, Autocorrelation Function and its Properties, Cross- Correlation Function and its Properties, Covariance Functions, Gaussian Random Processes, Poisson Random Process.

Random Processes - Spectral Characteristics: The Power Density Spectrum: Properties, Relationship between Power Density Spectrum and Autocorrelation Function, The Cross-Power Density Spectrum, Properties, Relationship between Cross Power Density Spectrum and Cross-Correlation

UNIT III

Classification of Stochastic Processes: Bernoulli, Markov Process: Markov chains in continuous time, Principles of discrete event simulation, Markov chain models of queueing systems,Gaussian Process, Martingales, Diffusions, Brownian Motion and White Noise, Poisson Processes, Renewal Processes: Generalized Renewal Processes and Renewal Limit.

UNIT IV

Random Signal Response of Linear Systems: Linear System with random input: Spectral factorization theorem and its importance, Convolution, Mean and Mean squared Value of System Response, autocorrelation Function of Response, Cross-Correlation Functions of Input and Output.

Spectral Characteristics of System Response: Power Density Spectrum of Response, Cross-Power Density Spectrums of Input and Output, Band pass, Band Limited and Narrowband Processes, Properties. Noise Definitions: White Noise, colored noise and their statistical characteristics, Ideal low pass filtered white noise, RC filtered white noise. Innovation process and whitening filter**.**

Textbook(s):

1. Probability, Random Variables and Random Signal Principles – Peyton Z. Peebles, TMH, 4th Edition, 2001.
2. Probability, Random Variables, and Stochastic Processes 3rd and 4th Editions by A. Papoulis.

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Reference Books:

1. Bernd Probability, Random Processes and Estimation Theory for Engineers, Henry Stark & John W. Woods
2. Probability Methods of Signal and System Analysis by George R. Cooper, Clave D. MC Gillem, 3rd Edition, Oxford, 1999.

Statistics, Statistical Modelling & Data Analytics Lab	L	P	C
		2	1

Discipline(s) / EAE / OAE	Semester	Group	Sub-group	Paper Code
CSE-AI/CSE-AIML/CSE-DS	6	PC	PC	DA-304P
EAE	6	AI-EAE	AI-EAE-2	DA-304P
EAE	6	AIML-EAE	AIML-EAE-2	DA-304P
EAE	6	DS-EAE	DS-EAE-1	DA-304P
EAE	6	SC-EAE	SC-EAE-1	DA-304P
EAE	6	MLDA-EAE	MLDA-EAE-1	DA-304P

Marking Scheme:

1. Teachers Continuous Evaluation: 40 marks
2. Term end Theory Examinations: 60 marks

Instructions:

1. The course objectives and course outcomes are identical to that of (Statistics, Statistical Modelling & Data Analytics) as this is the practical component of the corresponding theory paper.
2. The practical list shall be notified by the teacher in the first week of the class commencement under intimation to the office of the Head of Department / Institution in which the paper is being offered from the list of practicals below. Atleast 10 experiments must be performed by the students, they may be asked to do more. Atleast 5 experiments must be from the given list.

1. Exercises to implement the basic matrix operations in Scilab.
2. Exercises to find the Eigenvalues and eigenvectors in Scilab.
3. Exercises to solve equations by Gauss elimination, Gauss Jordan Method and Gauss Siedel in Scilab.
4. Exercises to implement the associative, commutative and distributive property in a matrix in Scilab.
5. Exercises to find the reduced row echelon form of a matrix in Scilab.
6. Exercises to plot the functions and to find its first and second derivatives in Scilab.
7. Exercises to present the data as a frequency table in SPSS.
8. Exercises to find the outliers in a dataset in SPSS.
9. Exercises to find the most risky project out of two mutually exclusive projects in SPSS
10. Exercises to draw a scatter diagram, residual plots, outliers leverage and influential data points in R
11. Exercises to calculate correlation using R
12. Exercises to implement Time series Analysis using R.
13. Exercises to implement linear regression using R.
14. Exercises to implement concepts of probability and distributions in R

Statistics, Statistical Modelling & Data Analytics	L	P	C
	3		3

Discipline(s) / EAE / OAE	Semester	Group	Sub-group	Paper Code
CSE-AI/CSE-AIML/CSE-DS	6	PC	PC	DA-304T
EAE	6	AI-EAE	AI-EAE-2	DA-304T
EAE	6	AIML-EAE	AIML-EAE-2	DA-304T
EAE	6	DS-EAE	DS-EAE-1	DA-304T
EAE	6	SC-EAE	SC-EAE-1	DA-304T
EAE	6	MLDA-EAE	MLDA-EAE-1	DA-304T

Marking Scheme:

1. Teachers Continuous Evaluation: 25 marks
2. Term end Theory Examinations: 75 marks

Instructions for paper setter:

1. There should be 9 questions in the term end examinations question paper.
2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type question of total 15 marks.
3. Apart from question 1 which is compulsory, rest of the paper shall consist of 4 units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain upto 5 sub-parts / sub-questions. Each Unit shall have a marks weightage of 15.
4. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook.
5. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.

Course Objectives :

1.	To impart basic knowledge about Statistics, visualisation and probability.
2.	To impart basic knowledge about how to implement regression analysis and interpret the results.
3.	To impart basic knowledge about how to describe classes of open and closed sets of R, concept of compactness Describe Metric space - Metric in Rn.
4.	To impart basic knowledge about how to apply Eigen values, Eigen vectors.

Course Outcomes (CO)

CO 1	Ability to learn and understand the basic concepts about Statistics, visualisation and probability.
CO 2	Ability to implement regression analysis and interpret the results. Be able to fit a model to data and comment on the adequacy of the model
CO 3	Ability to describe classes of open and closed sets of R, concept of compactness Describe Metric space - Metric in Rn.
CO 4	Ability to impart basic knowledge about how to apply Eigen values, Eigen vectors.

Course Outcomes (CO) to Programme Outcomes (PO) mapping (scale 1: low, 2: Medium, 3: High)

	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12
CO 1	3	3	3	3	3	-	-	1	2	-	-	3
CO 2	3	3	3	3	3	-	-	1	2	-	-	3
CO 3	3	3	3	3	3	-	-	1	2	-	-	3
CO 4	3	3	3	3	3	-	-	1	2	-	-	3

UNIT-I

Statistics: Introduction & Descriptive Statistics- mean, median, mode, variance, and standard deviation. Data Visualization, Introduction to Probability Distributions.
Hypothesis testing, Linear Algebra and Population Statistics, Mathematical Methods and Probability Theory, Sampling Distributions and Statistical Inference, Quantitative analysis.

UNIT-II

Statistical Modelling: Linear models, regression analysis, analysis of variance, applications in various fields. Gauss-Markov theorem; geometry of least squares, subspace formulation of linear models, orthogonal projections; regression models, factorial experiments, analysis of covariance and model formulae; regression diagnostics, residuals, influence diagnostics, transformations, Box-Cox models, model selection and model building strategies, logistic regression models; Poisson regression models.

UNIT-III

Data Analytics: Describe classes of open and closed set. Apply the concept of compactness. Describe Metric space - Metric in Rn. Use the concept of Cauchy sequence, completeness, compactness and connectedness to solve the problems.

UNIT – IV

Advanced concepts in Data Analytics: Describe vector space, subspaces, independence of vectors, basis and dimension. Describe Eigen values, Eigen vectors and related results.

Textbook(s):

1. Apostol T. M. (1974): Mathematical Analysis, Narosa Publishing House, New Delhi.
2. Malik, S.C., Arora, S. (2012): Mathematical Analysis, New Age International, New Delhi

References:

1. Pringle, R.M. and Rayner, A.(1971): Generalized Inverse of Matrices with Application to Statistics, Griffin, London
2. Peter Bruce, Andrew Bruce (2017), Practical Statistics for Data Scientists Paperback

VHDL Programming Lab	L	P	C
		2	1

Discipline(s) / EAE / OAE	Semester	Group	Sub-group	Paper Code
ITE	6	PCE	PCE-1	CIE-326P
ECE	6	PCE	PCE-1	ECE-306P
EE-VDT	6	PC	PC	ECE-306P
CSE-in-EA	7	OAE-CSE-EA	OAE-2	ES-403P
EC-ACT	7	OAE-ECE-EA	OAE-2	ES-403P
EAE	7	ES-EAE	ES-EAE-3B	ES-403P

Marking Scheme:

1. Teachers Continuous Evaluation: 40 marks
2. Term end Theory Examinations: 60 marks

Instructions:

1. The course objectives and course outcomes are identical to that of (VHDL Programming) as this is the practical component of the corresponding theory paper.
2. The practical list shall be notified by the teacher in the first week of the class commencement under intimation to the office of the Head of Department / Institution in which the paper is being offered from the list of practicals below. Atleast 10 experiments must be performed by the students, they may be asked to do more. Atleast 5 experiments must be from the given list.

1. Design all gates using VHDL.
2. Write VHDL programs for the following circuits, check the wave forms and the hardware generated

   i) half adder ii) full adder
3. Write VHDL programs for the following circuits, check the wave forms and the hardware generated

   i) multiplexer ii) demultiplexer
4. Write VHDL programs for the following circuits, check the wave forms and the hardware generated

   i) decoder ii) encoder
5. Write a VHDL program for a comparator and check the wave forms and the hardware generated
6. Write a VHDL program for a code converter and check the wave forms and the hardware generated
7. Write a VHDL program for a FLIP-FLOP and check the wave forms and the hardware generated
8. Write a VHDL program for a counter and check the wave forms and the hardware generated
9. Write VHDL programs for the following circuits, check the wave forms and the hardware generated

   i) ALU ii) shift register

VHDL Programming	L	P	C
	3		3

Discipline(s) / EAE / OAE	Semester	Group	Sub-group	Paper Code
ITE	6	PCE	PCE-1	CIE-326T
ECE	6	PCE	PCE-1	ECE-306T
EE-VDT	6	PC	PC	ECE-306T
CSE-in-EA	7	OAE-CSE-EA	OAE-2	ES-403T
EC-ACT	7	OAE-ECE-EA	OAE-2	ES-403T
EAE	7	ES-EAE	ES-EAE-3B	ES-403T

Marking Scheme:

1. Teachers Continuous Evaluation: 25 marks
2. Term end Theory Examinations: 75 marks

Instructions for paper setter:

1. There should be 9 questions in the term end examinations question paper.
2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type question of total 15 marks.
3. Apart from question 1 which is compulsory, rest of the paper shall consist of 4 units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain upto 5 sub-parts / sub-questions. Each Unit shall have a marks weightage of 15.
4. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook.
5. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.

Course Objectives :

1.	To provide knowledge of basics of VHDL Programming.
2.	To impart knowledge of Combinational logic circuit simulation and its implementation.
3.	To impart knowledge of simulation and implementation of Synchronous Sequential logic circuit.
4.	To impart knowledge of simulation and implementation of Asynchronous Sequential logic circuit.

Course Outcomes (CO)

CO 1	To understand the basics of VHDL Programming.
CO 2	To understand simulation and implementation of Combinational logic circuit.
CO 3	To understand simulation and implementation of Synchronous Sequential logic circuit.
CO 4	To understand simulation and implementation of Asynchronous Sequential logic circuit.

Course Outcomes (CO) to Programme Outcomes (PO) mapping (scale 1: low, 2: Medium, 3: High)

	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12
CO 1	2	2	3	3	2	2	2	-	1	2	2	3
CO 2	3	2	3	3	3	2	2	-	1	2	2	3
CO 3	3	2	3	3	3	2	2	-	1	2	2	3
CO 4	3	2	3	3	3	2	2	-	1	2	2	3

UNIT-I

Introduction to VHDL, design units, data objects, signal drivers, inertial and transport delays, delta delay, VHDL data types, concurrent and sequential statements, configuration declaration, instantiation.

UNIT-II

Combinational logic circuit design and VHDL implementation of following circuits –full adder, Subtractor, decoder, encoder, multiplexer, ALU, Subprograms – Functions, Procedures, attributes, generic, generate,

package, IEEE standard logic library, file I/O, test bench, barrel shifter, 4X4 key board encoder, multiplier, divider, Hamming code encoder and correction circuits.

UNIT-III

Sequential circuit design: flip-flops, registers, counters. **Synchronous Sequential circuit design:** finite state machines, Mealy and Moore, state assignments, design and VHDL implementation of FSMs, Linear feedback shift register (Pseudorandom and CRC).

UNIT – IV

Asynchronous sequential circuit design – primitive flow table, concept of race, critical race and hazards, design issues like metastability, synchronizers, clock skew and timing considerations Introduction to place & route process, Introduction to ROM, PLA, PAL, Architecture of CPLD and FPGA (Xilinx/Altera).

Textbook(s):

1. Stephen Brown, Zvonko Vranesic, “Fundamentals of Digital Logic with VHDL design”, TMH.
2. Douglas Perry , “VHDL” 4th Edition, TMH.

References:

1. J. Bhasker, “A VHDL Primmer”, Prentice Hall 1995.
2. Charles. H.Roth , “Digital System Design using VHDL”, PWS (1998)
3. John F. Wakerley , “Digital Design Principles And Practices” , Pearson Education
4. Navabi Z , “VHDL-Analysis & Modelling of Digital Systems”, McGraw Hill.
5. William I. Fletcher, “An Engineering Approach To Digital Design”, Prentice Hall
6. M. Morris Mano, “Digital Design 3rd Edition”, Pearson.

Wireless Sensor Networks	L	P	C
	3		3

Discipline(s) / EAE / OAE	Semester	Group	Sub-group	Paper Code
ECE	6	PCE	PCE-3	ECE-342T
CSE-IoT	6	PC	PC	IOT-328T
EAE	6	IOT-EAE	IOT-EAE-2C	IOT-332T
EAE	6	ICB-EAE	ICB-EAE-2C	IOT-332T
EEE	7	PCE	PCE-4	EEE-415T
CSE-NET	7	PC	PC	NET-475T
CSE-in-EA	7	OAE-CSE-EA	OAE-2	OECE-421T
EAE	7	NET-EAE	NET-EAE-5	NET-475T
OAE	7	ECE-OAE	ECE-OAE-4B	OECE-421T

Marking Scheme:

1. Teachers Continuous Evaluation: 25 marks
2. Term end Theory Examinations: 75 marks

Instructions for paper setter:

1. There should be 9 questions in the term end examinations question paper.
2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type question of total 15 marks.
3. Apart from question 1 which is compulsory, rest of the paper shall consist of 4 units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain upto 5 sub-parts / sub-questions. Each Unit shall have a marks weightage of 15.
4. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook.
5. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.

Course Objectives :

1.	To make students understand the basics of Wireless sensor Networks.
2.	To familiarize with learning of the Architecture of WSN.
3.	To familiarize with learning of the Architecture of WSN.
4.	To study the design consideration of topology control and solution to the various problems.

Course Outcomes (CO)

CO 1	Understand challenges and technologies for wireless networks.
CO 2	Understand architecture and sensors.
CO 3	Describe the communication, energy efficiency, computing, storage and transmission.
CO 4	Explain the concept of programming the in WSN environment.

Course Outcomes (CO) to Programme Outcomes (PO) mapping (scale 1: low, 2: Medium, 3: High)

	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12
CO 1	3	2	2	1	2	1	-	-	-	-	3	3
CO 2	3	2	2	1	2	1	-	-	-	-	3	3
CO 3	3	2	2	1	2	1	-	-	-	-	3	3
CO 4	3	2	2	1	2	1	-	-	-	-	3	3

UNIT-I

Introduction: Mobile Ad-hoc Networks (MANETs), Introduction to Sensor Networks, Constraints and Challenges, Advantage of Sensor Networks, Applications of Sensor Networks. Architecture: Single-Node

Architecture - Hardware Components, Energy Consumption of Sensor Nodes, Operating Systems, Network Architecture -Sensor Network Scenarios, Optimization Goals, Gateway Concepts.

UNIT-II

Networking Sensors: Physical Layer and Transceiver Design Considerations, MAC Protocols for Wireless Sensor Networks, classification of MAC protocols, MAC protocols for sensor network, location discovery, S-MAC, IEEE 802.15.4. Routing Protocols- Energy-Efficient Routing, Geographic Routing.

UNIT-III

Infrastructure Establishment: Topology Control, Clustering, Time Synchronization, Localization and Positioning, Sensor Tasking and Control. Case study of WSN‟s for different applications.

UNIT – IV

Platform, Tool and Security: Sensor Node Hardware – Berkeley Motes, Programming Challenges, Node-level software platforms, Node-level Simulators. Security issues in Sensor Networks. Future Research Direction.

Textbook(s):

1. Holger Karl and Andreas Willig, “Protocols And Architectures for Wireless Sensor Networks”, John Wiley.
2. Feng Zhao and Leonidas J. Guibas, “Wireless Sensor Networks- An Information Processing Approach”, Elsevier.
3. C.Siva Ram Murthy and B.S.Manoj, “Ad hoc Wireless Networks Architectures and Protocols”, Pearson Education.

References:

1. Dr. Xerenium, Shen, Dr. Yi Pan , “Fundamentals of Wireless Sensor Networks”, Theory and Practice”,Wiley.
2. KazemSohraby, Daniel Minoli, &TaiebZnati, “Wireless Sensor Networks- Technology, Protocols, And Applications”, John Wiley.

Wireless Sensor Networks Lab	L	P	C
		2	1

Discipline(s) / EAE / OAE	Semester	Group	Sub-group	Paper Code
ECE	6	PCE	PCE-3	ECE-342P
CSE-IoT	6	PC	PC	IOT-328P
EAE	6	IOT-EAE	IOT-EAE-2C	IOT-332P
EAE	6	ICB-EAE	ICB-EAE-2C	IOT-332P
EEE	7	PCE	PCE-4	EEE-415P
CSE-NET	7	PC	PC	NET-475P
CSE-in-EA	7	OAE-CSE-EA	OAE-2	OECE-421P
EAE	7	NET-EAE	NET-EAE-5	NET-475P
OAE	7	ECE-OAE	ECE-OAE-4B	OECE-421P

Marking Scheme:

1. Teachers Continuous Evaluation: 40 marks
2. Term end Theory Examinations: 60 marks

Instructions:

1. The course objectives and course outcomes are identical to that of (Wireless Sensor Networks) as this is the practical component of the corresponding theory paper.
2. The practical list shall be notified by the teacher in the first week of the class commencement under intimation to the office of the Head of Department / Institution in which the paper is being offered from the list of practicals below. Atleast 10 experiments must be performed by the students, they may be asked to do more. Atleast 5 experiments must be from the given list.

1. Introduction of Wireless sensor network applications and its simulation.
2. Network Simulator installation of wireless sensor network
3. Write TCL script for transmission between mobile nodes.
4. Write TCL script for sensor nodes with different parameters.
5. Generate tcl script for udp and CBR traffic in WSN nodes.
6. Generate tcl script for TCP and CBR traffic in WSN nodes.
7. Implementation of routing protocol in NS2 for AODV protocol.
8. Implementation of routing protocol in NS2 for DSR protocol.
9. Implementation of routing protocol in NS2 for TORA protocol.
10. Study other wireless sensor network simulators (Mannasim. Contiki.)