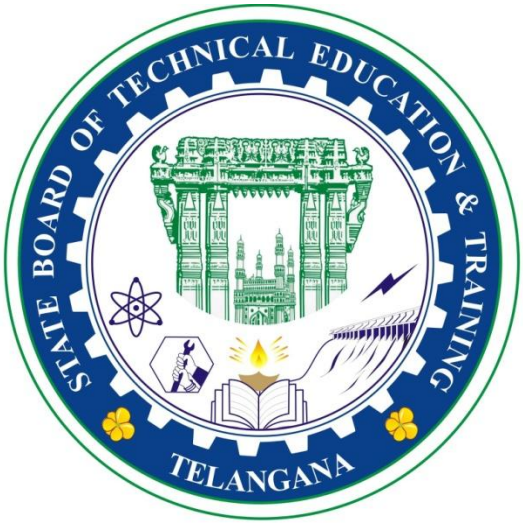
C24-CURRICULUM

DIPLOMA IN

ELECTRONICS AND COMMUNICATION ENGINEERING



Offered By

STATE BOARD OF

TECHNICAL EDUCATION AND TRAINING TELANGANA HYDERABAD

V SEMESTER

S. NO	Course		Teaching Scheme					Examination Scheme						
			Instruction Periods per week			Total Periods per semester	Credits	Continuous Internal Evaluation (CIE)			Semester End Examination (SEE)			
	Code	Course Name	L	T	P			Mid Sem 1	Mid Sem 2	Internal Evaluation	Max marks	Min marks	Total Marks	Min marks for passing including internal
1	EC-501	Entrepreneurship &Startups	4	1	0	75	2.5	20	20	20	40	14	100	End Marks shall be ≥35% of Topper Marks and Subject Total Shall be ≥ D-Hybrid Grade Minimum
2	EC-502	Mobile & Optical Fibre Communication	4	1	0	75	2.5	20	20	20	40	14	100	
3	EC-503	Digital Circuit Design using Verilog HDL	4	1	0	75	2.5	20	20	20	40	14	100	
4	EC-504	Industrial & power electronics	4	1	0	75	2.5	20	20	20	40	14	100	
5	CS-505(A)	Internet of Things (IoT)	4	1	0	75	2.5	20	20	20	40	14	100	
	EC-505(B)	Signals and Systems												
6	EC-506A	Embedded Systems with Arduino	4	1	0	75	2.5	20	20	20	40	14	100	
	CS 506(B)	Machine Learning												
7	EC-507	DigitalC ircuit Design using Verilog HDL Lab	1	0	2	45	1.25	20	20	20	40	20	100	End Marks shall be ≥50% of Topper Marks and Subject Total Shall be ≥ D-Hybrid Grade Minimum
8	EC-508	Industrial & Power Electronics lab	1	0	2	45	1.25	20	20	20	40	20	100	
9	EC-509	IOT & Arduino Programming Lab	1	0	2	45	1.25	20	20	20	40	20	100	
10	EC-510	Project Work	1	0	2	45	1.25	20	20	20	40	20	100	
			28	6	8	630	20	200	200	200	400	164	1000	

EC-501 – ENTREPRENEURSHIP AND STARTUPS

Course Title	**Entrepreneurship And Start ups**	Course Code	**EC-501**
SEMESTER	**V SEMESTER**	Course Group	**Core**
Teaching Scheme in periods (L : T : P)	**4:1: 0**	Credits	**2.5**
Methodology	**Lecture + Tutorial**	Total Contact Periods	**75**
CIE	**60 Marks**	SEE	**40 Marks**

Pre requisites

Knowledge of Basic finance and business knowledge

Course Outcomes

On successful completion of the course, the students will be able to

Course Outcomes	
CO1	Comprehend different management practices like Leadership and Ownership, resource Institutes
CO2	Identify the dynamic role of entrepreneurship and Startups in India and Telangana State by Acquiring Entrepreneurial spirit and resourcefulness, quality, competency, and motivation
CO3	Identify Business Ideas and Develop plans to implement
CO4	Comprehend basic concepts of financial management and their application
CO5	Identify and Assess the effectiveness and suitability of various support agencies and incubators in India and Telangana State
CO6	Build Project Proposal and Understand CSR, Ethics, Ex-Im and Exit strategies

Course Contents

UNIT- 1 Management Practices **Duration: 12 Periods (L: 9 – T:3)**

Explain the concept and differences between Industry - Commerce and Business - Describe various types of ownerships in the Organization - Explain different types of leadership models - Analyze the nature and importance of various functions of management.

UNIT-2 Introduction to Entrepreneurship and Start – Ups **Duration: 13 Periods (L: 10 – T:3)**

Define Entrepreneurship- Discuss characteristics and functions of Entrepreneurship- Identify different types of Entrepreneurships-Compare the concepts of entrepreneur and intrapreneur and find out the motivation behind it -Distinguish between Entrepreneur and Managers - Identify 7-M Resources - Know MSME & Startup India –Startup Telangana, Start up Scheme- types, Importance, Features, Eligibility for Startup registration, Benefits

UNIT- 3 Business Ideas and their implementation **Duration: 13 Periods (L: 10 – T:3)**

Finding Ideas and making an activity map - Develop the plans for creating and starting the business - Identify business using the ideation canvas and the business model canvas- Discuss market research related terms- Outline market mix related terms - Define Product related terminologies - Emphasize on Innovation - Explain concept of Risk and SWOT.

UNIT-4 Finance Management **Duration: 12 Periods (L: 10 – T:2)**

Introduction – Objectives of Financial Management – Types of capitals – sources of raising capital – Start-ups funding types-venture capital funding-crowd funding-series funding- Types of budgets – production budgets – labour budgets – Concept of Profit and loss Account – Concept of balance sheet – proforma – types of taxes – brief concepts of – Excise Tax, Service Tax, Income Tax, GST and custom duty.

UNIT-5 Support Agencies and Incubators **Duration: 13 Periods (L: 10 – T:3)**

State level and National level sources of information- various central Government institutions and their functions (like NSIC,SIDO,SISI and SSIB)- Telangana State industry policy-Demographic merits of Telangana state to set up SSIs-Names of state level institutions and their functions(Like SSIDC,DIC,APIITCO)-Banks that support SSIs like SIDBI,APSFC-Thrust areas and core sector as per Telangana state industry policy-Classification of the projects as per TSIP-Special assistance schemes for women and SC/ST entrepreneurs Features of TS-IPASS. Legal Issues – Contracts-Copyrights – Insurance- IPR- Licensing- Patents- Trade Secrets- Trademarks.

UNIT-6 - Project Proposal & Exit Strategy **Duration: 12 Periods (L: 10 – T:2)**

To work on the development of a project proposal - Describe social responsibility and relate with economic Performance. - Explain managerial ethics - To know Ex-Im Policies - Identify suitable strategies of succession and harvesting

Reference Books

S. No	Title of Book	Author	Publication with place, Year and ISBN
1	Entrepreneurship in Action	Coulter	PHI2nd Edition
2	Entrepreneurship Development	E.Gordon &K. Natarajan	Himalaya
3	Entrepreneurship	Robert D. Hisrich& Mathew J. Manimala	McGraw Hill Education; ISBN978-1259001635
4	Entrepreneurial Development	SS Khanka	S Chand & Company;ISBN:978-8121918015
5	Entrepreneurship Development and Management	A. K. Singh	Jain Book Agency(JBA) publishes, NewDelhi
6	The Startup Owner's Manual: The Step-by-Step Guide for Building a Great Company	Steve Blank and Bob Dorf	K&S Ranch ISBN– 978-0984999392
7	The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses	EricRies	Penguin UK ISBN– 978-0670921607
8	Entrepreneurship	Roy Rajeev	Oxford University Press; ISBN:978-0198072638
9	Industrial Engineering and Management	O.P.Khanna	Dhanpat Rai and Sons, Delhi
10	Industrial Organization and Management	Tara Chand	Nem Chand and Brothers; Roorkee
11	Industrial Management and Entrepreneurship	V.K. Sharma.	Scientific Publishers, New Delhi
12	Entrepreneurship Development and Small Business Enterprise	Poornima M Charantimath	Pearson Education;ISBN:978-8131759196
13	Entrepreneurship Development	S Anil kumar	NEWAGEIntern.Pvt Ltd;ISBN:978-8122414349

Suggested E-learning resources

Sr. No.	Topic Key Word	Link
1	MoCI	https://www.india.gov.in/website-ministry-commerce-and-industry
2	MSME	1)https://msme.gov.in/ 2) https://www.msmex.in/learn/government-schemes-for-startups-and-msmes-in-india/
3	Start-up, Stand-up India &start-up Telangana	1) https://www.startupindia.gov.in/ 2) https://www.standupmitra.in 3) https://udyamimitra.in/page/standup-india-loans 4) https://www.ssipgujarat.in/
4	Make in India	https://www.makeinindia.com/
5	Atmanirbhar Bharat Abhiyan Vocal for Local	https://indiancc.mygov.in›uploads›2021/08
6	Skill India	https://skillindia.gov.in
7	Start-ups telangana	https://startup.telangana.gov.in/government-policies/
8	MSDE	https://www.msde.gov.in/

Suggested Learning Outcomes

Upon completion of the course the student shall be able to

CO-1:- Select suitable Management practices like leadership and Ownership, resource institutes :-

1.1 Differentiate industry, Commerce and business,
1.2 Demonstrate various types of ownerships in the organization,
1.3 Illustrate different types of leadership models,
1.4 List various functions of management
1.5 Explain the nature and importance of various functions of management.
1.6 State the need for Planning in management
1.7 Explain Staffing- Recruitment and management of talent.
1.8 List merits and Demerits of various functions of management.
1.9 Differences between Management and Administration

CO-2 :- Identify the dynamic role of entrepreneurship and Startups in India and Telangana State by Acquiring Entrepreneurial spirit and resourcefulness, quality, competency, and motivation:-

2.1 Define Entrepreneurship
2.2 Explore characteristics and functions of entrepreneurship
2.3 Identify different types of Entrepreneurships
2.4 Compare the concepts of entrepreneur and intrapreneur and find out the motivation behind it
2.5 Distinguish between entrepreneur and managers
2.6 Identify 7-M Resources
2.7 Understand MSME & Start-up India
2.8 Identify Start-up schemes in Telangana
2.9 Interpret the importance of Start up Schemes
2.10 List the important features of Start-up schemes in Telangana State
2.11 Determine the Eligibility for start-up registration and understand the process
2.12 Explore the Benefits of Start-up registration

CO-3:- Identify Business Ideas and Develop plans to implement:-

3.1 List the steps in new business idea generation.
3.2 List the major steps involved in idea generation
3.3 Define brain storming, divergent thinking, creative Problem- solving.
3.4 Illustrate SCAMPER Technique.
3.5 List various steps involved in product Identification
3.6 Explain various phases of creating and starting the business
3.7 Explain marketing plan
3.8 List key components of Financial Plan.
3.9 List various Sources of Capital
3.10 Identify Business opportunity and evaluation.
3.11 Define market research related terms- Questionnaire design ,Sampling ,Market survey, Data analysis & interpretation
3.12 Outline Marketing Mix (4Ps- product, price, promotion, place)
3.13 Define Product Terms like PLC, Mortality Curve, New product Development Steps, Inventory, Supply Chain Management
3.14 State the Importance of Innovation,
3.15 Define concept of innovation
3.16 Describe the process of innovation.
3.17 Explain Risk analysis and mitigation by SWOT Analysis

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CO-4:-Comprehend basic concepts of financial management and their application

4.1 Define Finance Management
4.2 List Objectives of Financial Management,
4.3 List Types of capitals,
4.4 Identify Sources of raising capital
4.5 List Start-ups funding types
4.6 Explain Venture capital funding
4.7 Explain Series funding
4.8 Explain Crowd funding
4.9 List Types of budgets-production budget – labour budget
4.10 Explain Concept of Profit loss Account,
4.11 Illustrate Concept of balance sheet– proforma
4.12 List Types of taxes imposed by Central Government and State Government
4.13 Detail concepts of – Excise Tax, Income Tax, GST and custom duty.

CO-5:- Overview of Support Agencies and Incubators:-

5.1 Identify State level and national level sources of information on Start-ups
5.2 Detail functions of Various central Government institutions (like NSIC,SIDO,SISI and SSIB)
5.3 Detail important features of Telangana State industry policy.
5.4 List Demographic merits of Telangana state to set up SSIs.
5.5 List the Names of state level institutions that support SSIs
5.6 Explain the role of institutions like SSIDC, DIC, APIITCO in setting up SSIs.
5.7 Explain role of Banks that support SSIs like SIDBI, APSFC.
5.8 Identify Thrust areas and core sector as per Telangana state industry policy.
5.9 Classify the projects as per TSIP.
5.10 Explain Special assistance schemes for women and SC/ST Entrepreneurers.
5.11 List Features of TS-IPASS.
5.12 Explain Legal Issues –Contracts-Copyrights –Insurance – IPR – Licensing-Patents-Trade Secrets-Trademarks.

CO-6:-Building Project Proposal & Understand CSR, Ethics, Ex-Im, & Exit strategies

6.1 Outline the steps involved in Project Planning and report
6.2 Explain Feasibility study of project
6.3 Explain the process of Project cost estimation
6.4 Define and explain Breakeven analysis
6.5 Define the terms Return on investment and Return on sales
6.6 Describe social responsibility and relate with economic Performance.
6.7 Explain Business Ethics
6.8 Describe Ex-Im Policies
6.9 Identify suitable strategies of succession and harvesting.
6.10 Explain Bankruptcy and avoidance

Suggested Student Activities

Other than the classroom learning, following are the suggested student-related co-curricular activities which can be undertaken to accelerate the attainment of the various outcomes in this course. Students should make a portfolio i.e. perform at least FIVE from following list of activities individually or in group (not more than 2 students). They should prepare reports of about 2-5 pages for each activity and collect/ record physical evidence for their portfolio which may be useful for their placement interviews:

i. Develop two products from household waste (attach photographs).
ii. Download product development and innovative films from internet
iii. Prepare a collage for "Traits of successful entrepreneurs."/ "Motivation & Charms of Entrepreneurship".
iv. Invite entrepreneurs, industry officials, bankers for interaction. Interview atleast four entrepreneurs or businessman and identify
v. Identify your hobbies and interests and convert them into business idea.
vi. Mock Business Model- Choose a product and design a unique selling preposition, brand name, logo, advertisement (print, radio, and television), jingle, packaging, and labelling for it.
vii. Develop your own website. Share your strengths and weakness on it. Declare your time bound goals and monitor them on the website.
viii. Choose any product / advertisement and analyse its good and bad points/ cost sheet/ supply chain etc. (individuals should select different ads).
ix. Compare schemes for entrepreneurship promotion of any bank.
x. Prepare sign boards representing safety measures.
xi. Prepare a project report on following policies implemented by Telangana under Start-ups
    ELECTRONICS POLICY-2016
    Innovation policy-2016
    Industrial policy-2014 etc.,

Legends: R = Remember; U= Understand; A= Apply and above levels (Bloom's revised taxonomy)

CO-PO Mapping Matrix

	Basic and Discipline Specific Knowledge	Problem Analysis	Design/Development of Solutions	Engineering Tools, Experimentation and Testing	Engineering Practices for Society, Sustainability and Environment	Project Management	Lifelong Learning	Linked PO
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO 7	
CO1	1					1		1,6
CO2	1	1			1	2	1	1,2,5,6,7
CO3	1	2	2		1	1	2	1,2,3,5,6,7
CO4	1					2	1	1,6,7
CO5	2				1		2	1,5,7
CO6	1				2	2	1	1,5,6,7

MODEL QUESTION PAPERS
STATE BOARD OF TECHNICAL EDUCATION & TRAINING:TS:HYDERABD
EC-501- ENTREPRENEURSHIP AND STARTUPS
V SEMESTER MID SEMESTER – I MODEL PAPER

Time: 1 hour **Max. Marks:20**

PART-A **4x1=4Marks**

NOTE: 1) Answer all questions and each carries **one** mark.
2) Answers should be brief and straight to the point and shall not be exceed three simple sentences.

1. What is merits of managements ?
2. List the functions of management?
3. Define Entrepreneurship
4. Define start-ups.

PART-B **2X3M=6 Marks**

NOTE: 1) Answer all questions and each carries **three** marks.
2) Answers should be comprehensive and the criterion for valuation is the content but not length of the answer.

5. (a) List out the element of cost?

OR

(b) Explain about staffing and need for recruitment .

6. (a) Discuss characteristics of entrepreneurship**.**

OR

(b) Illustrate about MSME?

PART-C **2X5M=10 Marks**

NOTE: 1) Answer all questions and each carries **five** mark.
2) Answers should be comprehensive and the criterion for valuation is the content but not length of the answer.

7. (a) Describe various types of ownerships in the organization,

OR

(b)Explain different types of leadership models,

8. (a) Compare the concepts entrepreneur and intrapreneur

OR

(b) Identify 7-M Resources

MODEL QUESTION PAPERS
STATE BOARD OF TECHNICAL EDUCATION & TRAINING:TS:HYDERABD
EC-501- ENTREPRENEURSHIP AND STARTUPS
V SEMESTER MID SEMESTER – II MODEL PAPER

Time: 1 hour **Max. Marks:20**

PART-A **4X1=04 Marks**

NOTE: 1) Answer all questions and each carries **one** mark.
2) Answers should be brief and straight to the point and shall not be exceed three simple sentences.

1. What is the full form SWOT?
2. State need for business plan?
3. Full form of GST?
4. List types of budget ?

PART-B **2X3M=6 Marks**

NOTE: 1) Answer all questions and each carries **three** mark.
2) Answers should be comprehensive and the criterion for valuation is the content but not length of the answer.

5. (a) What is the need for planning?

OR

(b) What is mean by market planning?

6. (a) explain series funding?

OR

(b) List types of taxes imposed by Central Government and State Government

PART-C

NOTE: 1) Answer all questions and each carries **five** mark. **2X5M=10 Marks**
2) Answers should be comprehensive and the criterion for valuation is the content but not length of the answer.

7. (a) Identify different marketing mix and illustrate their importance

Or

(b) Examine different business opportunities

8. (a) Explain the concept of profit loss account

OR

(b) Explain briefly types of budgets .

MODEL QUESTION PAPERS
STATE BOARD OF TECHNICAL EDUCATION & TRAINING:TS:HYDERABD
EC-501- ENTREPRENEURSHIP AND STARTUPS
V SEMESTER END SEMESTER MODEL PAPE

Time: 2 Hours **Max. Marks:40**

PART-A

Instructions: 1. Answer **ALL** questions. 8 X 1 = 8
2. Each question carries **ONE** mark.

1. What is mean by Marketing plan?
2. Define crowd funding.
3. What is mean by balance sheet?
4. List any two support agencies promoting entrepreneurship ?
5. Mention any two features of TS-IPASS?
6. What is mean by project planning
7. What is mean by breakeven?
8. Mention any two business ethics?.

PART-B

Instructions: 1. Answer **ALL** questions. 4 X 3 = 12
2. Each question carries **THREE** marks.

9. (a) List any six Telangana Start-ups schemes.

OR

9. (b) List functions of management
10. (a)explain about crowd funding.

OR

10. (b) Explain about return on investment .
11.(a) Outline the Telangana state industry policy.

OR

11.(b) Classification of the projects as per TSIP
12 (a) Mention the importance of Business Ethics?

OR

12. (b) Illustrate briefly about bankruptcy?

PART-C

Instructions: 1. Answer **ALL** questions. 4 X 5 = 20
2. Each question carries **FIVE** marks.

13.(a) Explain Marketing Mix (4Ps- product, price, promotion, place)

OR

13.(b) Evaluate different types of budgets?
14 (a) Explain various phases of creating and starting the business

OR

14(b) Explain Ex-Im policies
15 (a) Explain the Telangana state industry policy

OR

15.(b) Illustrate the special assistance schemes for women and SC/ST Entrepreurers
16(a) What is Break Even analysis? Illustrate graphically the concept of Break -Even point.

OR

16.(b) Illustrate suitable strategies of succession and harvesting.

EC-502 : MOBILE & OPTICAL FIBRE COMMUNICATIONS

Course Title:	**Mobile & Optical Fibre Communications**	Course Code	**EC-502**
Semester	**V Semester**	Course Group	**Core**
Teaching Scheme in Periods (L:T:P)	**4:1:0**	Credits	**2.5**
Methodology	**Lecture+Tutorials**	Total Contact Periods	**75**
CIE	**60 Marks**	SEE	**40 Marks**

Pre requisites

Required basic knowledge of Communication, electronics and skill in handling various sophisticated electronic equipment as well as measuring instruments

Course Outcomes

Upon completion of the course, the student shall be able to

CO1	Outline the principle of Radar
CO2	Comprehend Satellite Communication
CO3	Analyze the different Concepts of Mobile Communication System
CO4	Analyze the Modern Wireless Communication Systems
CO5	Use of FibreOptic Communication and interpret the use of Optical Components, Devices
CO6	Analyse Optical measuring instruments and ExplainWave Length Division Multiplexing

Course Content and Blue Print of Marks for SEE

Unit No	Unit Name	Periods	Questions to be set for SEE			
			R		U	A
I	Radar	10	Q4	Q1	Q9(a)	Q13(a)
II	Satellite communication	15				
III	Basic concepts of mobile communication	12		Q2	Q10(a)	Q14(a)
IV	Modern wireless communication	13				

V	Understand the basics of optical fibre communication	12		Q3	Q5,Q6	Q9(b),Q11(a), Q11(b)	Q13(b),Q15(a), Q15(b)
VI	Optical measuring instrument and wavelength division multiplexing	13			Q7,Q8	Q10(b),Q12(a), Q12(b)	Q14(b),Q16(a), Q16(b)
	Total	75	8			8	8

Course Contents

UNIT - 1: Radar **Duration: 10 Periods (L: 8 – T:2)**

Block diagram of Radar-Principle of Radar - Basic Radar range equation- Range performance factors from range equation- Block diagramof pulsed Radar system- Need for duplexer in Radar- Working of branch type Duplexer - Types of indicators used in radar systems – Principle of A-scope& PPI display - Disadvantages of Pulsed radar- Principle of CW radar- Block diagram of CW radar- Limitations of a CW Radar- Block diagram of MTI Radar- Applications of various radar systems

UNIT - 2: Satellite Communication **Duration: 15Periods (L:13 – T:2)**

Microwave link uses-fixed microwave link with block diagram-need for satellite communication -classify satellites- advantages of satellite communication over terrestrial radio communication- features of satellites in LEO, MEO, GEO - applications of satellites - azimuth and elevation with reference to satellites--terms apogee and perigee- uplink frequency and down link frequency in c-band & Ku-band –block diagram of communication satellite - Types transponders used in satellites – block diagram explanation of single conversion- double conversion- and regenerative transponders - block diagram explanation of Earth station

UNIT - 3: Basic Concepts of Mobile communication **Duration: 12Periods (L:10 – T:2)**

Limitations of conventional mobile phone system-mobile Station& Base Station - roamer-Functions of Mobile Switching Centre (MSC) – Voice &Control Channels- Frequency Division Duplex (FDD) and Time Division Duplex (TDD)-Uplink and Downlink channels in mobile communication-Block diagram of a basic cellular system-Call progress in a Cellular telephone system- Hexagonal cell site-Frequency reuse-Capacity of a mobile cellular system-Cell &Cluster- Relation between capacity and cluster size-Choosing of co channel cells-Types of interferences-Summarizeinterferences-Types of hands-off- Outline hand-off procedure-Types of Channel Assignment Strategies-Fixed Channel Assignment- Dynamic Channel Assignment -Methods to increase capacity-Cell Splitting -Sectoring- Micro-cell zone concept- Umbrella cell.

UNIT – 4: Modern Mobile Communication Systems Duration: 13 Periods (L:11– T:2)

Features of digital cellular system - Global system for Mobile Communication (GSM) - architecture –GSM channels- GSM services - security aspects in GSM- features of Enhanced Data Rates GSM Evolution (EDGE)- Architecture of DECT-Specifications of Digital EuropeanCordless Telecommunication(DECT) system -Features of Digital European Cordless Telecommunication (DECT)system-Compare the features of GSM, GPRS and EDG-Drawbacks of micro cell - Use of intelligent cell concept -Advantages of implementing intelligent Cell-Intelligent micro cell operation – Applications of intelligent micro cell system - Classification of mobile data networks – Block diagram of wireless local loop(WLL) -Merits of WLL- Salient features of 3G system – Salient features of 4G system –Advantages of 5G – Compare features of 3G,4G &5Gsystems

UNIT - 5: Basics of Optical Fiber Communication Duration: 12 Periods(L:10T:2)

Merits of Light wave communication system over EM wave systems - Optical Spectral Bands - Structure of optical fiber - Classification of optical Fibers based on refractive index profile & core diameter - Single mode fiber&Multimode fiber - Advantages of SMFs over MMFs - Total internal reflection in optical fiber - Define acceptance angle-Define cone of acceptance- Define Numerical Aperture (NA) - Relation between acceptance angle & numerical aperture - Various losses in optical fibers- Classification of dispersions in optical fibres - Polarization mode dispersion - Various fibre optic components- Need for connectors in ofc -Optical attenuator in ofc – Optical attenuatorin ofc - Splicing-Comparison between mechanical & fusion Splice - Use of optical coupler/splitter

UNIT - 6: Optical measuring instruments & wavelength division multiplexing
Duration: 13Periods (L:11 – T:2)
Working of Optical Time Domain Reflecto meter(OTDR)- Block diagram of Fibre Optic Communication system – Construction &working principle of LASER Diode - Construction and Working of Avalanche photo diode (APD)- Principle of Optical Time Domain Multiplexing- Define wave length division multiplexing-Block diagram of WDM –Compare wideband WDM and narrowband WDM – Blockdiagram of dense wavelength division multiplexing (DWDM)using transponders – Need for repeaters in ofc - need for EDFA-Block diagram of Erbium Doped Fibre Amplifier (EDFA)- Applications of EDFA-Comparison of Repeaters and Optical amplifiers – Use of fibres in local telephone network and in Cable TV application

Reference Books

1.Mobile and Personal Communication Systems and Services by Raj Pandya, PHI

2. Wireless Communications-Principles and Practice by Theodore S. Rappaport,PEARSON

3. Mobile Cellular Telecommunications-Analog and Digital systems by Willium C. Y.Lee, McGrawHill

Suggested E-learning resource

1) http://electrical4u.com/
2) www.electronics-tutorials.ws
1) www.nptel.ac.in

Suggested Learning Outcomes

Upon completion of the course, the student shall be able to

CO1: Outline the principle of Radar

1.1 Draw the block diagram of Radar
1.2 State the principle of Radar
1.3 Derive the basic Radar range equation
1.4 Identify the performance factors affecting the range
1.5 Draw the block diagram of pulsed Radar system and identify the function of each block
1.6 State the need ofDuplexer in Radar
1.7 Explain the working of branch type Duplexer
1.8 List the types of indicators used in radar systems
1.9 Explain the principle of A-Scope & Plan Position Indicator
1.10 List the disadvantages of pulsedradar.
1.11 State principle used incontinuous radar (CW)
1.12 Draw the block diagram of CW radar& identify the function of each block
1.13 List the limitations of a CW Radar
1.14 Draw and explain the block diagram of MTI Radar
1.15 List the applications of various Radar systems

CO2: Comprehend Satellite Communication

2.1 List the uses of microwave links
2.2 Draw the block diagram of fixed microwave link and identify the function of each block
2.3 State the need for Satellite in broad band communication
2.4 Classify Satellites
2.5 List the advantages of satellite communication over terrestrial radio communication
2.6 List the features of LEO,MEO& GEO satellites
2.7 List the applications of satellites
2.8 Define azimuth and elevation with reference to satellites
2.9 Define the terms apogee and perigee
2.10 Define uplink frequency and down link frequency used in C-Band & KU -Band
2.11 Draw the block diagram of communication satellite& identify the function of each block
2.12 List the types of transponders used in satellites
2.13 Draw the block diagram of single conversion Transponder& explain
2.14 Draw the block diagram of Double- Conversion Transponder& explain
2.15 Explain the Principle used in Regenerative Transponder
2.16 Draw the block diagram of Earth station& identify the function of each block

CO3: Analyze the different Concepts of Mobile CommunicationSystem

3.1 List the limitations of conventional mobile phone system
3.2 Define the terms mobile station, base station and Roamer
3.3 List the functions of Mobile switching Centre (MSC)
3.4 Identify the need forVoice and control channels in mobile communication
3.5 Compare frequency division duplex (FDD) and time division duplex(TDD)
3.6 Define Uplink and downlink channels in mobile communication
3.7 Show the block diagram of a basic mobile cellular system
3.8 Demonstrate the process of call progress in a cellular telephone system
3.9 Illustrate the selection of cell site as hexagonal shape
3.10 Outline the concept of frequency reuse in mobile communication
3.11 Define the terms Cell and cluster
3.12 Utilize the concept of frequency reuse to relate capacity of a cellular system
3.13 Show the relation between capacity and cluster size.
3.14 How to choose Co- Channel Cells
3.15 List the types of interferences
3.16 Summarize adjacent channel and co-channel interference in mobile communication
3.17 List the types of hands-off in mobile communication
3.18 Outline hand-offsprocedure in mobile communication
3.19 List the types of Channel assignment strategies
3.20 Explain fixed Channel assignment strategies in cellular communication
3.21 Explain Dynamic Channel assignment strategies in cellular comm
3.22 List the methods to increase the capacity of cell communication
3.23 Illustrate the Cell Splitting
3.24 Illustrate Cell Sectoring
3.25 Demonstrate Micro- Cell Zone concept
3.26 Outline the Umbrella cell concept

CO4: Analyze the Modern Wireless Communication Systems

4.1 List the features of digital cellular system
4.2 Draw the architecture of Global System for Mobile (GSM) & identify the function of each
4.3 Name GSM channels
4.4 List the different Services offered in GSM
4.5 Outline the security measures in GSM
4.6 List the features of Enhanced Data Rates GSM Evolution (EDGE)
4.7 Draw the architecture of Digital European Cordless Telecommunication (DECT) system& explain each
4.8 List specifications of Digital European Cordless Telecommunication (DECT) system
4.9 List the features of DECT system
4.10 Compare features of GSM, GPRS & EDGE technologies
4.11 List the drawbacks of micro cell system
4.12 Show the importance of intelligent cell concept in mobile communication
4.13 List the advantages of implementing intelligent cell
4.14 Apply the intelligent cell concept & build the micro cell
4.15 Applications of intelligent micro cell system
4.16 Classify mobile data networks
4.17 Draw the block diagram of Wireless local loop and explain
4.18 List the merits of WLL

4.19 List the salient features of 3G, 4G
4.20 List the advantages of 5Gsystems
4.21 Compare the features of 3G, 4G& 5Gsystems

CO5: Use of Fiber Optic Communication and interpret the use of Optical Components, Devices

5.1 List the advantages of Light wave communication system over EM wave
5.2 Show the optical spectral bands
5.3 Show the structure of optical fibre
5.4 Classify optical fibres based on refractive index profile
5.5 Classify optical fibres based on core diameter
5.6 Illustrate the refractive index profile for step index fibre
5.7 Illustrate the refractive index profile for graded index fibre
5.8 Define Single mode fibre (SMF)
5.9 Define multimode fibre (MMF)
5.10 Relate the advantages of SMFs and MMFs.
5.11 Outline the principle of total internal reflection in optical fibre.
5.12 Define acceptance angle, cone of acceptance and Numerical Aperture (NA)
5.13 Show the relation between acceptance angle and Numerical Aperture (NA)
5.14 List various losses in optical fibres
5.15 Explain various losses that occur in optical fibres
5.16 Classify different types of dispersions that occur in optical fibres
5.17 Explain dispersions in optical fibres.
5.18 Illustrate the Polarization Mode Dispersion
5.19 List various fibre optic components
5.20 Recall the use of connectors, Optical attenuator and Optical isolator in ofc
5.21 Define splicing of fibres
5.22 Compare mechanical splice and fusion splice
5.23 Find the use of optical coupler/Splitter in optical fibre communication

CO6: Analyze Optical measuring instruments and Explain Wave Length Division Multiplexing

6.1 Demonstrate the working of Optical Time-Domain Reflectometer (OTDR) for analyzing fibre cables
6.2 Draw the block diagram of Fibre Optic Communication System and explain each block.
6.3 Construct the LASER diode & outline the working principle of LASER source
6.4 Construction the Avalanche Photo Diode (APD)& outline the principle of working
6.5 Show the block diagram of Optical Time DomainMultiplexing (OTDM)& illustrate the multiplexing of optical signals
6.6 Define wave length division multiplexing(WDM)
6.7 Show the block diagram of WDM system& identify the function of each
6.8 Compare wide band multiplexing and narrow band multiplexing
6.9 Draw the block diagram of Dense WDM (DWDM) & illustrate multiplexing using wave length converting transponders
6.10 State the need for repeaters in Fibre Optic Communication
6.11 Draw the block diagram of Erbium Doped Fibre Amplifier (EDFA)& explain each block
6.12 List the applications of EDFA in OFC
6.13 Compare repeaters and optical amplifiers in optical fibre communication
6.14 Select the fibre optic cables for its use in local telephone network and Cable TV

Suggested Student Activities

1. Visit the Institute's Library / internet center and list the books/journals/ e-books and any otherresources available on the topics suggested by the teacher.
2. Prepare a chart showing evolution of mobile communication
3. Prepare a chart showing the different types of fibre optic components
4. Prepare a chart showing handling different fibre optic tools
5. Prepare a PPT identifying the need for security measures required inmobile communication and their use in day to day life
6. Conducting industrial visit to technical training institute like IRISET to attain knowledge about identify and use of fiber optic tools
7. Local industrial visit to BSNL to study about various blocks of mobile communication Available at Base station and observe antenna system at base station
8. Identify the different types of Cables used for mobile communication
9 Local industrial visit to Satellite Earth Station to observe the satellite pass and Know tracking of dish antenna

CO-PO Mapping Matrix

	Basic and Discipline Specific Knowledge	Problem Analysis	Design/Development of Solutions	Engineering Tools, Experimentation and Testing	Engineering Practices for Society, Sustainability and Environment	Project Management	Lifelong Learning	Linked PO
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO 7	
CO1	2							1,
CO2	2					2		1,6
CO3	3		1		2	1	1	1,3,5,6,7
CO4	2				1		2	1,5,7
CO5	2			2		2	1	1,4,6,7
CO6	2					3	2	1,6,7

State Board of Technical Education and Training,Telangana
Model Question paper
DECE I semester
Mid Semester-I Examination

Course Code:EC-502 **Duration:1 hour**
Course Name: Mobile & Optical Fibre Communication **Max.Marks:20 Marks**

PART-A

Answer **all** questions, Each Question carries **ONE** mark **4x1 = 4 Marks**

1. State the need for duplexer

2. List any two disadvantages of Pulsed Radar

3. Define uplink & down link frequency in Satellite communication

4. Define Apogee & Perigee

PART-B

Answer **TWO** questions. Each question carries **THREE** marks **2x3 = 6 Marks**

5(a). Draw the simple block diagram of Radar

(OR)

5(b). List any three applications of Radar

6(a) Llist any three advantages of Satellite communication over terrestrial system

(OR)

6(b) Define elevation & azimuth reference to satellite.

PART-C

Answer **TWO** questions. Each question carries **FIVE** marks **2x5= 10 Marks**

7(a). Derive the Radar range equation & mention the parameters affecting range

(OR)

7(b) Draw the block diagram of CW Radr and explain the function of each block

8(a) Draw the single conversion transponder and and explain the function of each block

(OR)

8(b) Draw the block diagram of fixed microwave link and explain function of each

State Board of Technical Education and Training,Telangana
Model Question paper
DECE I semester
Mid Semester-II Examination

Course Code:EC-502 **Duration:1 hour**
Course Name:**Mobile & Optical Fibre Communication** **Max.Marks:20 Marks**

PART-A

Answer **ALL** questions, Each Question carries **ONE** mark **4x1 = 4 Marks**

1. Define Mobile station and Base station

2. Define Cell and Cluster

3. List any two merits of Wireless Local Loop

4. mention the types of Hands -off in cellular communication

PART-B

Answer TWO questions. Each question carries **THREE** marks. **2x3 = 6 Marks**

5(a)Mention any three functions of Mobile Switching Centre

(OR)

5(b) Compare 3G & 4G systems with three points

6(a) List any three specifications of EDGE technology

(OR)

6(b) List the advantages of implementing Intelligent Cell

PART-C

Answer **TWO** questions. Each question carries **FIVE**marks **2x5 = 10 Marks**

7(a). Explain the Umbrella Cell Concept

(OR)

7(b). Explain fixed channel & dynamic channel assignment stratergy

8(a) Draw the architecture of GSM & explain the function of each

(OR)

8(b) Compare GSM,GPRS & EDGE with five points

State Board of Technical Education and Training,Telangana
Model Question paper
DECE IV semester
I Semester End Examination

Course Code:EC-502 **Duration:2 hours**
Course Name::Mobile & Optical Fibre Communication **Max.Marks: 40 Marks**

PART-A

Answer **all** questions. Each Question carries one mark **8x1 = 8 Marks**

1. List any two types of Radar displays

2. List any two losses that occur in optical fibres?

3.State the need for frequency reuse in mobile communication

4. Mention any two applications of intelligent micro cell system

5.Define the term Numerical aperture in Fiber

6. Define splicing in fiber

7.State the need for Repeater in fibre optic communication

\8. What is the need for Wave length division multiplexing in fibre optic communication

PART-B

Answer **FOUR** questions.Each question carries **three** marks. **4 x 3 = 12 Marks**

9(a) Daw the block diagram of Pulsed radar

(OR)

9(b)Outline the principle of total internal reflection in fibre

10(a) Distinguish between frequency division duplex (FDD) and time division duplex (TDD)?

(OR)

10(b) Compare Repeater and optical amplifier with three points

11(a)Distinguish between wideband WDM and narrowband WDM

(OR)

11(b) Classify the optical fibres

12(a) Draw the block diagram of Wave length division multiplexing

(OR)

12(b) List any three applications of EDFA

PART-C

Answer **FOUR** questions. Each Question carries **FIVE** marks **4 x 5 = 20 Marks**

13(a) Draw the block diagram of MTI Radar and expain

(OR)

13(b) Explain about DECT Radio Link?

14(a)Explain total internal reflection in optical fibre?

(OR)

14(b) Explain Optical Time Division Multiplexing (OTDM)?

15(a) Explain basic concept of Wireless Local Loop (WLL)?

(OR)

15(b) Explain the architecture of DECT?

16(a) Draw and explain the block diagram of Dense Wavelength Division Multiplexing (DWDM)?

(OR)

16(b) Draw and explain the block diagram of Erbium Doped Fibre Amplifier (EDFA)

EC-503 : DIGITAL CIRCUIT DESIGN USING VERILOG HDL

Course title :	Digital Circuit Design using Verilog HDL	Course Code	EC-503
Semester	V	Course Group	Core
Teaching Scheme in Periods(L:T:P)	4:1:0	Credits	2.5
Methodology	Lecture + Tutorial	Total Contact Periods:	75
CIE	60 Marks	SEE	40 Marks

1.

Pre requisites

1. Concepts of switching theory.
2. Knowledge of Combinational and Sequential Circuits.
3. Familiarity with a programming language like C or C++.

Course Outcomes

Upon completion of the course, the student shall be able to

CO1	Comprehend Verilog HDL basic concepts
CO2	Use Verilog HDL constructs and conventions
CO3	Design Combinational logic circuits using Gate level and Data flow modeling
CO4	Use concepts of Behavioural modelling
CO5	Develop and Test the Combinational and Ssequential logic circuits
CO6	Design Finite State machines and Construc t PLDs

Course Content and Blue Print of Marks for SEE

<table>
<tr><th rowspan="2">Unit No</th><th rowspan="2">Unit Name</th><th rowspan="2">Periods</th><th colspan="4">Questions to be set for SEE</th></tr>
<tr><th colspan="3">R</th><th>U</th><th>A</th></tr>
<tr><td>I</td><td>Introduction to Verilog HDL</td><td>13</td><td rowspan="6">Q4</td><td colspan="2" rowspan="2">Q1</td><td rowspan="2">Q9(a)</td><td rowspan="2">Q13(a)</td></tr>
<tr><td>II</td><td>Language Constructs and Conventions</td><td>12</td></tr>
<tr><td>III</td><td>Gate level and Data Flow modeling</td><td>13</td><td colspan="2" rowspan="2">Q2</td><td rowspan="2">Q10(a)</td><td rowspan="2">Q14(a)</td></tr>
<tr><td>IV</td><td>Behavioral modeling</td><td>12</td></tr>
<tr><td>V</td><td>Modeling of Combinational and Sequential Logic circuits using Behavioral Modelling</td><td>13</td><td rowspan="2">Q3</td><td>Q5,Q6</td><td>Q9(b),Q11(a), Q11(b)</td><td>Q13(b),Q15(a), Q15(b)</td></tr>
<tr><td>VI</td><td>System design concepts</td><td>12</td><td>Q7,Q8</td><td>Q10(b),Q12(a), Q12(b)</td><td>Q14(b),Q16(a), Q16(b)</td></tr>
<tr><td></td><td>Total</td><td>75</td><td colspan="3">8</td><td>8</td><td>8</td></tr>
</table>

Course Contents:

Unit 1: Introduction to Verilog HDL **Duration:13 Periods (L: 11- T: 2)**

Steps involved in the design flow for the VLSI IC design-Importance of Hardware Description Languages in VLSI design-Features of Verilog HDL - Compare VHDL and Verilog HDL- Identify the components of a Verilog module definition - Distinguish between modules and module instances in Verilog HDL - Concept of instantiation and inference of a component - Port connection rules in module instantiation - Levels of abstraction to represent the internals of the module- Hierarchical modeling concepts.

Unit 2: Language Constructs and Conventions **Duration:12 Periods (L: 10 - T: 2)**

Lexical conventions like number specification, Identifiers, Keywords -Different data types like value set, nets, registers, vectors, integer, real, arrays, memories and strings - Expressions, operators and operands -Types of operators used in the Verilog HDL - defparam and localparam keywords - System tasks and compiler directives

Unit 3: Gate level and Data Flow modeling **Duration:13 Periods (L: 11 - T: 2)**

Logic gates primitives provided in Verilog - Instantiation of gates, gate symbols, and truth tables for and/or and buf/not types gates - Rise, fall and turn off delays in gate level design - Assignment statements used in data flow modeling - Different types of delays used in the data flow level - Compare Gate level and Data flow modeling - Design Combinational logic circuits using Gate level and Data flow modeling.

Unit 4: Behavioral modeling **Duration:12 Periods (L: 10 - T: 2)**

Initial and Always statements - Blocking and Non blocking procedural assignments -Timing controls like delay based timing control and event based timing control - Conditional statements - Use of if and else if statements - Use of case, casex and casez statements - Looping statements such as while, for, repeat and forever-Sequential and parallel blocks - User Defined Primitives (UDP)

Unit 5: Modeling of Combinational and Sequential Logic circuits using Behavioral Modelling **Duration:13 Periods (L: 11 - T: 2)**

Design of Combinational circuits like 1-bit comparator and ALU - Design of RS, JK, T and D flip flops - Iimplementation of shift registers like SISO, PIPO - Design of synchronous UP counter and Down counters - Importance of stimulus block - Structure of Stimulus module-stimulus modules for Combinational and sequential circuits .

Unit 6: System design concepts **Duration:12 Periods (L: 10 - T: 2)**

Concept of Finite State Machines - Types of FSM - Compare Mealy and Moore types of state machines - Design of Mealy state machine using Verilog HDL - Design of Moore state machine using Verilog HDL - Types of Programmable Logic Devices - Architecture of PLAs -Architecture of PLAs - Architecture of FPGAs - Applications

Reference Books

1. Digital systems design by Morris Mano
2. Verilog HDL: A guide to digital design and synthesis by S. Palnitkar
3. Advanced Digital Design with VERILOG HDL by Michael D. Ciletti
4. Switching and finite automation theory by ZviKohavi
5. Digital state machine design by David J. Comes
6. Digital Systems by Ronald Tocci
7. Digital design principles and practice- John F Wakerly, PHI / Pearson education Asia 3rd Edn,2005
8. Design through Verilog HDL – T.R. Padmanabhan and B. Bala Tripura Sundari, WSE, IEEE Press, 2004.
9. A Verilog Premier – J. Bhasker, BSP, 2003.
10. Fundamentals of Logic Design with Verilog – Stephen. Brown and Zvonko Vranesic, TMH, 2005.

Suggested E-Learning Resources

1. https://electrical4u.com
2. www.electronics-tutorials.ws
3. www.nptel.ac.in
4. https://m.youtube.com
5. www.learning.intel.com
6. www.cadence.com
7. www.udemy.com
8. ProgrammimgHomeworkHelp.com
9. www.courseera.com
10. www.amd.com

Suggested Learning Outcomes:

Upon completion of the course, the student shall be able to

CO1 : Comprehend Verilog HDL basic Concepts

1.1 Illustrate the steps involved in the design flow for the VLSI IC design

1.2 State the need for Hardware Description Languages in VLSI design

1.3 List the various types of HDLs.

1.4 List the features of Verilog HDL

1.5 Compare VHDL and Verilog HDL

1.6 Identify the components of a Verilog module

1.7 Distinguish between Module and Module instances in Verilog

1.8 Explain the concept of Iinstantiation of a component / module in design

1.9 Explain the port connection rules in a module instantiation

1.10 Explain four levels of abstraction to represent the internals of a module

1.11 Explain about the hierarchical modeling/ Design methodologies

1.12 List the advantages of hierarchical modeling.

CO2: Use Verilog HDL constructs and conventions

2.1 Explain the lexical conventions like number specification, Identifiers, keywords

2.2 Explain different data types like value set, nets, registers, vectors, integer, arrays, memories and strings with example

2.3 Define expressions, operators and operands.

2.4 Explain different types of operators used in the Verilog HDL with example

2.5 Compare defparam and localparam keywords

2.6 Explain about system tasks

2.7 Explain about compiler directives

CO3: Design Combinational logic circuits using Gate level and Data flow modeling

3.1 Identify the logic gate primitives provided in Verilog

3.2 Write the truth tables for and/or and buf,/not gates.

3.3 Iinstantiatete gates with example.

3.4 Explain Rise, fall and turn-off delays in the gate level modeling.

3.5 Explain the assignment statements in data flow modeling

3.6 Explain different types of delays used in the data flow level modeling

3.7 List the advantages of data flow modeling over gate level modeling

3.8 Design Half adder using Gate level Modeling .

3.9 Design Half adder using Data Flow Modeling

3.10 Design Full adder using Gate Level Modeling

3.11 Design Full adder using Data Flow Modeling

3.12 Design Half Subtractor using Gate Level Modeling

3.13 Design Half Subtractor using Data Flow Modeling

3.14 Design Full Subtractor using Gate Level Modeling

3.15 Design Full Subtractor using Data Flow Modeling

3.16 Design 4X1 Multiplexer using Gate Level Modeling

3.17 Design 4X1 Multiplexer using Data Flow Modeling

3.18 Design 1X4 De-multiplexer using Gate Level Modeling

3.19 Design 1X4 De-multiplexer using Data Flow Modeling

3.20 Design 4:2 Encoder using Gate Level Modeling

3.21 Design 4:2 Encoder using Data Flow Modeling

3.22 Design 2:4 Decoder using Gate Level Modeling

3.23 Design 2:4 Decoder using Data Flow Modeling

CO4: Use concepts of Behavioural modelling

4.1 Explain initial and always statements with example

4.2 Explain blocking and non blocking procedural assignments with example

4.3 Explain timing controls like delay based timing control and event based timing control

4.4 Explain use of if, if - else, if-else-if statements with example

4.5 Explain use of case, casex and casez statements

4.6 Explain looping statements such as while, for, repeat, and forever.

4.7 Explain sequential and parallel blocks.

4.8 Define User Defined Primitives (UDP)

4.9 State the need for UDPs

4.10 List the types of UDPs

CO5: Develop and Test the Combinational and Sequential logic circuits

5.1 Design Arithmetic Logic Unit(ALU) and 1-bit comparator using Behavioral Modeling

5.2 Design RS, D, JK and T flip flops using Behavioral Modeling

5.3 Design shift registers like SISO, PIPO.

5.4 Design 4-bit Synchronous Up-counter and Down-Counter.

5.5 Define the stimulus block/test bench module.

5.6 State the need for stimulus block/test bench module.

5.7 Give the structure of Stimulus block.

5.8 Design Stimulus module for Half Adder and Full Adder (Combinational circuits)

5.9 Design Stimulus module for T Filp flop and D Flip Flop(Sequential circuits)

CO6: Design Finite State machines and construct PLDs

6.1 Define Finite State Machine

6.2 List the types of FSMs

6.3 Distinguish between Mealy and Moore State Machines.

6.4 Explain the design of Mealy State Machine using Verilog HDL with simple example

6.5 Explain the design of Moore state machine using Verilog HDL with simple example

6.6 List the Applications of FSM

6.7 list the various types of Programmable Logic Devices

6.8 Detail the Architecture of PLA

6.9 Detail the Architecture of PAL

6.10 Detail the Architecture of FPGA

6.11 List the applications of PLDs .

Suggested Student Activities

1.Student may visit Library to refer to Manuals and related books of Verilog HDL Programming

2. Student may Search for the available Design Tools Such as Xlinx ISE, ModelSim, Mentor Graphics.

3. Student may visit nearby Industry like AMD, Qualcomm, Meadiatek to familiarize with Front End And Back End designing.

4. Student may participate in the Quiz &Internship provided by VEDA IIT.

5. Student may search internet for knowing latest updates in VLSI IC designs.

6. Student may involve in design of practical applications Traffic light controller, vending machines.

7. Student may design simple projects and implement it on FPGA board.

CO-PO Mapping Matrix

	Basic and Discipline Specific Knowledge	Problem Analysis	Design/Development of Solutions	Engineering Tools, Experimentation and Testing	Engineering Practices for Society, Sustainability and Environment	Project Management	Lifelong Learning	Linked PO
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO 7	
CO1	3	1	1	1				1,2,3,4
CO2	3	2	2	2				1,2,3,4
CO3	2	3	3	2				1,2,3,4
CO4	2	2	3	3				1,2,3,4
CO5			3	3				3,4
CO6	1	3	3	1		1		1,2,3,4,6

Model Paper for Mid-I

BOARD DIPLOMA EXAMINATIONS (C-24)

V SEMESTER, EC-503

DIGTAL CIRCUIT DESIGN USING VERILOG HDL

Time :**1** Hr Total Marks :20Marks

PART-A

Answer **all** questions, each carries **one** marks 4 X 1 = 4

1. Write any 2 differences between VHDL and Verilog HDL
2. What is module instantiation?
3. List any two system tasks used in Verilog HDL.
4. Define expression and operator.

PART-B

Answer **all** questions, each carries **three** marks 2 X 3 = 6

5. a) Explain the importance of HDLs in VLSI design.

   OR

   b) Explain the difference between module and module instance.
6. a) Explain about arrays and vectors in verilog HDL

   OR

   b) Explain about compiler directives used in Verilog HDL.

   .

PART-C

Answer **all** questions, each carries **five** marks 2 X 5 = 10

7. a)Explain about the four levels of abstraction Supported by Verilog HDL

   OR

   b) Explain the design methodologies with neat sketch,
8. a) Explain the data types - value set and registers

   OR

   b) Explain different types of operators used in Verilog HDL.

Model Paper for Mid-II

BOARD DIPLOMA EXAMINATIONS, (C-24)

V SEMESTER, EC-503

DIGTAL CIRCUIT DESIGN USING VERILOG HDL

Time :**1** Hr Total Marks:20Marks

PART-A

Answer **all** questions, each carries **one** marks 4 X 1 =4

1. Write the truth table of basic primitive - ***and*** gate
2. Give the syntax of continuous assignment statement
3. List the conditional statements used in Behavioral modeling.
4. What is meant by UDP?

PART-B

Answer **all** questions, each carries **three** marks 2 X 3 = 6

5. a) List the advantages of data flow modeling over gate level modeling.

OR

b) Design half adder circuit using gate level and data flow modeling.

6. a) Explain about initial statement.

OR

b) Explain about casex, casez statements.

PART-C

Answer **all** questions, each carries **five** marks 2 X 5 = 10

7. a) Design 2 to 4 decoder using data flow modeling.

OR

b) Design full adder logic circuit using gate level modeling.

8. a) Explain ***while loop*** and ***for loop*** with simple example.

OR

b) Explain blocking and non blocking procedural assignments with examples

Model Paper for SEE

BOARD DIPLOMA EXAMINATIONS (C-24)

V SEMESTER, EC-503

DIGTAL CIRCUIT DESIGN USING VERILOG HDL

Time :**2**Hrs Total Marks: 40Marks

PART-A

Answer **all** questions, each carries **one** marks 8 X 1 =8.

1. List any two features of Verilog HDL.
2. Define Rise delay in gate level modeling.
3. LIst the types of UDPs.
4. Define stimulus module.
5. State the need for Stimulus module.
6. Define Finite State machine.
7. List the applications of FSMs.
8. List the types programmable logic devices

PART-B

Answer **all** questions, each carries **three** marks 4 X 3 =12

9. a) Explain four levels of abstraction to represent the internals of a module.

OR

b) Design D flip flop using behavioral modeling.

10. a) Explain the assignment statements in data flow modeling.

OR

b) Explain the architecture of PLAs.

11. a) Design 1-bit comparator using Behavioral modeling.

OR

b) Design T flip flop using behavioral modeling.

12. a) Explain the architecture of PLA

OR

b). Explain the architecture of PAL.

PART-C

Answer **all** questions, each carries **five** marks 4 X 5 =20

13. a) Explain port connection rules in a module instantiation

OR

b) Design 4-bit Synchronous Up counter using Verilog HDL.

14. a) Design a Half Adder using gate level and dataflow level modelling**.**

OR

b) Explain the design of Moore state machine using Verilog HDL with an example.

15. a) Design a JK flip-flop and write its Test bench using Verilog HDL.

OR

b) Design a 4-bit SISO register using behavioral modeling.

16. a) Explain the design of Moore state machine using Verilog HDL with an example.

OR

b) Explain the Architecture of FPGA

EC-504 : INDUSTRIAL & POWER ELECTRONICS

Course Title:	**INDUSTRIAL & POWER ELECTRONICS**	Course Code	**EC-504**
Semester	**V Semester**	Course Group	**Core**
Teaching Scheme in Periods (L:T:P)	**4:1:0**	Credits	**2.5**
Methodology	**Lecture+Tutorials**	Total Contact Periods	**75**
CIE	**60 Marks**	SEE	**40 Marks**

Pre requisites

Knowledge of Electronics devices and circuits.

Course Outcomes

Upon completion of the course, the student shall be able to

CO1	Use of Power Electronics Devices
CO2	Analyze Applications of thyristors
CO3	Use of thyristors as choppers and inverters
CO4	Comprehend the working of transducers and MEMS
CO5	Use of PLCs & develop simple circuits using SCADA
CO6	Apply Control Engineering Techniques to minimize circuits

Course Content and Blue Print of Marks for SEE

No	Unit Name	Periods	Questions to be set for SEE			
			R		U	A
I	Thyristors	15	Q4	Q1	Q9(a)	Q13(a)
II	Applications of thyristor	10				
III	Applications of thyristors as choppers and inverters	13		Q2	Q10(a)	Q14(a)
IV	Transducers & MEMS	12				
V	PLCs & SCADA Basics	13	Q3	Q5,Q6	Q9(b),Q11(a), Q11(b)	Q13(b),Q15(a), Q15(b)
VI	Control Engineering	12		Q7,Q8	Q10(b),Q12(a), Q12(b)	Q14(b),Q16(a), Q16(b)
	Total	75	8		8	8

Course Content

Unit-1 Thyristors **Duration:15 Periods (L: 12– T:3)**

Different thyristor family devices- circuit symbols - Constructional details of SCR- Working of SCR using two Transistor analogy- Volt-Ampere characteristics of SCR- Ratings of SCR- forward break over voltage, latching current, holding current, turn on triggering time, turn off time of SCR- characteristics of Diac & Triac under forward/Reverse bias- Compare SUS, SBS, SCS & LASCR- SCR circuit triggering by UJT - input and Output waveforms- Volt-ampere characteristics of Diac - Volt-ampere characteristics of Triac- Phase control circuit using Diac and Triac for AC power control- input and output waveforms. Important specifications of power electronic devices - Important applications of power electronic devices

Unit-2 Applications of thyristors **Duration:10 Periods (L: 8– T:2)**

Need for. controlled rectifier- single phase half-wave controlled rectifier with resistive load- single phase full -wave controlled rectifier with resistive load- 3-phase half-wave controlled rectifier with resistive load- 3- phase full -wave controlled rectifier with resistive load . Applications of controlled rectifiers

Unit-3 Applications of thyristors as choppers and inverters

Duration:13 Periods(L:10-T:3)

Principle of chopper-chopper control strategies-constant frequency chopper-variable frequency chopper-step up step down chopper--first quadrant(type A)chopper-second quadrant(type B) type C chopper type B chopper-Four quadrant chopper-applications-inverters-need of inverter-types of inverters-series inverter- -single phase inverter

Unit-4 Transducers & MEMS **Duration:12 Periods (L: 10– T:2)**

Classification of transducers on the basis of principle of operation and applications- Working principle, construction and applications of strain gauge- Working principle, construction and applications of potentiometric transducer- Working principle, construction of capacitive transducers- Important applications of transducers- Working principle, construction and applications of LVDT- Working principle and construction of Piezo electric transducer- Uses for the Piezo electric transducer- Working principle of Thermocouple transducer- Important applications of above transducers- .MEMS

Unit-5 PLCs & SCADA Basics **Duration:13 Periods (L:10-T:3)**

Need for PLC- principle of PLCs- advantages and disadvantages of PLC's- functional block diagram of PLC- Ladder diagrams - ladder diagram for OR, AND, XOR logic and PLC code-importance of PLC timers with examples- importance of PLC counters with examples- features of popular PLCs like Siemens , Allenbradly- applications of PLCS- importance of SCADA- typical SCADA system- applications of SCADA.

Unit-6 Control Engineering **Duration:12 Periods (L:10– T:2)**

Definition of the System and Control system and its classification- Basic block diagram of control system-Open loop control system with examples-Merits and demerits of open loop control-Closed loop system with the help of a block diagram-Examples for closed loop system-Comparison of Open and closed loop control systems-Transfer function-block diagram reduction techniques- simple problems on reduction techniques.

Reference Books

1. Principles Of Electronics : V.K.Mehta
2. Electronic devices & circuits: Millman & halkies
3. Electronic devices & circuits: JB Gupta

Suggested E-learning references

1) http://electrical4u.com/
1) www.electronics-tutorials.ws
2) www.nptel.ac.in

Suggested Learning Outcomes

Upon completion of the course, the student shall be able to

CO1: **Use of Power Electronics Devices**

1.1 List different thyristor family devices
1.2 Draw the circuit symbols for each device.
1.3 Explain constructional details of SCR.
1.4 Explain the working of SCR using two Transistor analogy.
1.5 Explain the Volt-Ampere characteristics of SCR.
1.6 Mention the important ratings of SCR.
1.7 Define forward break over voltage, latching current, holding current, turn on triggering time, turn off time of SCR.
1.8 Distinguish between SUS, SBS, SCS & LASCR
1.9 Explain SCR circuit triggering by UJT with a circuit diagram and Draw input and Output waveforms.
1.10 Explain the working and Volt-ampere characteristics of Diac
1.11 Explain the working and Volt-ampere characteristics of Triac.
1.12 Explain the Phase control circuit using Diac and Triac for AC power control and draw the input and output waveforms.
1.13 Give important specifications of power electronic devices from Manufacturer's data sheet.
1.14 List the important applications of power electronic devices.

CO2: **Analyze Applications of thyristors**

2.1 Identify the need for a controlled rectifier
2.2 Define controlled rectifier
2.3 Draw single phase half-wave controlled rectifier circuit
2.4 Explain the operation of single phase half-wave controlled rectifier with resistive load
2.5 Draw single phase full -wave controlledrectifier circuit
2.6 Explain the operation of single phase full -wave controlled rectifier with resistive load
2.7 Draw 3-phase half-wave controlledrectifier circuit
2.8 Explain the operation of 3- phase half wave controlled rectifier with resistive load
2.9 Draw 3-phase full wave controlled rectifier circuit
2.10 Explain the operation of 3-phase full wave controlled rectifier with resistive load
2.11 List applications of controlled rectifiers

CO3: Use of thyristors as choppers and inverters

3.1 Explain the working principle of chopper
3.2 Classify the different chopper control strategies
3.3 Explain the operation of step-down chopper with waveforms
3.4 Explain the operation of step-up chopper with waveforms
3.5 Classify the different chopper circuit configurations
3.6 Explain above configurations in detail
3.7 Define inverter.
3.8 State the need for an inverter
3.9 Classify inverters.
3.10 Draw series inverter circuit
3.11 Explain the operation of series inverter
3.12 Explain the operation of single phase bridge voltage source inverter with waveforms

CO4: Comprehend the working of transducers and MEMS

4.1 Classify transducers on the basis of principle of operation and applications.
4.2 Explain the working principle, construction and applications of strain gauge transducer
4.3 Explain the working principle, construction and applications of potentiometric transducer.
4.4 Explain the working principle, construction of capacitive transducers.
4.5 Mention the 6 important applications of above transducers.
4.6 Explain the working principle, construction and applications of LVDT.
4.7 Explain the working principle and construction of Piezo electric transducer.
4.8 List any 3 uses of Piezo electric transducer
4.9 Draw Thermocouple transducer circuit
4.10 Explain Thermocouple transducer.
4.11 Mention any 6 important applications of above transducers.
4.12 Identify need for MEMS
4.13Mention applications of MEMS

CO5: Use of PLCs & develop simple circuits using SCADA

5.1 State the need for PLC
5.2 Explain the basic principle of PLCs.
5.3 List out the advantages and disadvantages of PLC's.
5.4 Draw and explain the functional block diagram of PLC.
5.5 Explain the Ladder diagrams
5.6 Draw ladder diagram for OR logic
5.7 Draw ladder diagram for AND logic
5.8 Draw ladder diagram for XOR logic
5.9 Explain the importance of PLC timers with examples.
5.10 Explain the importance of PLC counters with examples.
5.11 List the features of popular PLCs like Siemens , Allenbradly .
5.12 List any 4 applications of PLCS in the industry.
5.13 Mention the importance of SCADA.
5.14 Explain a typical SCADA system.5.15 List the applications of SCADA.

CO6: Apply Control Engineering Techniques to minimize circuits

6.1 Define system and Control system.
6.2 Classify control system
6.3 Explain the basic block diagram of control system
6.4 Explain an open loop control system.
6.5 Give examples for open loop control system.
6.6 Give three merits and demerits of open loop control.
6.7 Explain the closed loop system with the help of a block diagram.
6.8 Give Examples for closed loop system
6.9 Compare Open loop and closed loop control systems.
6.10 Define Transfer function
6.11 Explain block diagram reduction techniques.
6.12 Solve simple problems using the above techniques.

Suggested Student Activities

1. Visit the Institute's Library / internet center and list the books/journals/ e-books and any other resources available on the topics suggested by the teacher.
2. Prepare a chart showing the symbols and names of various devices.
3. Prepare a PPT identifying the need for these semiconductor devices and their use in electronic industry.

CO-PO Mapping Matrix

	Basic and Discipline Specific Knowledge	Problem Analysis	Design/Development of Solutions	Engineering Tools, Experimentation and Testing	Engineering Practices for Society, Sustainability and Environment	Project Management	Lifelong Learning	Linked PO
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO 7	
CO1	2							1,
CO2	2		1			1		1.3.6
CO3	2		1		1	1		1.3,5,6
CO4	2		2		1	1		1.3,5,6
CO5	2	1	2			1	1	1,2,3,6,7
CO6	2	2	3			2	1	1,2,3,6,7

State Board of Technical Education and Training,Telangana
Model Question paper
DECE V semester
Mid Semester-I Examination

Course Code: EC-504 **Duration:1 hour**
Course Name: INDUSTRIAL & POWER ELECTRONICS
Max.Marks: 20 Marks

PART-A

Answer **all** questions, Each Question carries **ONE** mark **4x1 = 4 Marks**

1. List different thyristor family devices
2. Mention the important ratings of SCR.
3. Define controlled rectifier
4. Mention applications of controlled rectifier

PART-B

Answer **TWO** questions. Each question carries **THREE** marks **2x3 = 6 Marks**

5(a). Distinguish between SUS, SBS

(OR)

5(b). Give important specifications of power electronic devices

6(a). Draw single phase half-wave controlled rectifier circuit

(OR)

6(b). Identify the need for a controlled rectifier

PART-C

Answer **TWO** questions. Each question carries **FIVE** marks **2x5= 10 Marks**

7(a). Explain the working of SCR using two Transistor analogy.

(OR)

7(b). Explain the working and Volt-ampere characteristics of Triac.

8(a). Explain the operation of single phase half-wave controlled rectifier with resistive load

(OR)

8(b) . Explain the operation of 3-phase full wave controlled rectifier with resistive load

State Board of Technical Education and Training,Telangana
Model Question paper
DECE V semester
Mid Semester-II Examination

Course Code:EC-504 **Duration:1 hour**
Course Name: INDUSTRIAL & POWER ELECTRONICS **Max.Marks:20 Marks**

PART-A

Answer **ALL** questions, Each Question carries **ONE** mark **4x1 = 4 Marks**

1. Classify the different chopper control strategies
2. Define inverter
3. Mention applications of strain gauge transducer
4. List any 3 uses of Piezo electric transducer

PART-B

Answer **TWO** questions. Each question carries **THREE** marks. **2x3 = 6 Marks**

5(a). State the need for an inverter

(OR)

5(b). Draw series inverter circuit

6(a). Classify transducers on the basis of principle of operation and applications

(OR)

6(b). Draw Thermocouple transducer circuit

PART-C

Answer **TWO** questions. Each question carries **FIVE**marks **2x5 = 10 Marks**

7(a). Explain the operation of step-up chopper with waveforms

(OR)

7(b). Explain the operation of series inverter

8(a). Explain the working principle, construction and applications of strain gauge.

(OR)

8(b). Explain the working principle, construction and applications of LVDT

State Board of Technical Education and Training,Telangana

Model Question paper

DECE V semester

V Semester End Examination

Course Code:EC-504 **Duration:2 hours**

Course Name: INDUSTRIAL & POWER ELECTRONICS

Max.Marks: 40 Marks

PART-A

Answer **all** questions. Each Question carries one mark **8x1 = 8 Marks**

1. Mention the important ratings of SCR
2. Mention applications of MEMS
3. List the applications of SCADA
4. Classify inverters
5. List out the advantages of PLC's
6. List any 4 applications of PLCS in the industry
7. Classify control systems
8. Define Transfer function

PART-B

Answer **FOUR** questions.Each question carries **three** marks. **4 x 3 = 12 Marks**

9(a). Draw 3-phase full wave controlled rectifier circuit

(OR)

9(b). 7 Draw ladder diagram for AND logic

10(a). Mention any 6 important applications of LVDT

(OR)

10(b). Compare Open loop and closed loop control systems

11(a). Give three merits and demerits of open loop control.

(OR)

11(b). Give Examples for closed loop system

12(a). Define system and Control system

(OR)

12(b). Classify control systems and give example

PART-C

Answer **FOUR** questions. Each Question carries **FIVE** marks **4 x 5 = 20 Marks**

13(a) Explain the Volt-Ampere characteristics of SCR

(OR)

13(b) Draw and explain the functional block diagram of PLC.

14(a) Explain the operation of single phase bridge voltage source inverter with waveforms

(OR)

14(b) Explain the basic block diagram of control system

15(a) Explain the Ladder diagrams

(OR)

15(b) Explain a typical SCADA system.

16(a) Explain the closed loop system with the help of a block diagram

(OR)

16(b) Explain block diagram reduction techniques.

CS-505A- INTERNET OF THINGS (IOT)

Course Title:	**Internet of Things (IoT)**	Course Code	**CS-505A**
Semester	**V Semester**	Course Group	**Elective**
Teaching Scheme in Periods (L:T:P)	**60:15:0**	Credits	**2.5**
Methodology	**Lecture+Tutorials**	Total Contact Periods	**75**
CIE	**60 Marks**	SEE	**40 Marks**

Pre-requisites

Knowledge of basic programming skills in python, networking concepts and basic electronic components.

Course Outcomes

Upon completion of the course, the student shall be able to

CO1	Familiarize with Internet of Things Physical and Logical Design and Levels.
CO2	Understand IoT System Management with NETCONF-YANG
CO3	Understand Internet of Things, its hardware & software components and applications.
CO4	Interpret IoT Application Development
CO5	Discuss Security, Privacy and Governance in IoT
CO6	Explain IIoT and Case studies for IoT Design

Course Content and Blue Print of Marks for SEE

<table>
<tr><td rowspan="2">Unit No</td><td rowspan="2">Unit Name</td><td rowspan="2">Periods</td><td colspan="4">Questions to be set for SEE</td></tr>
<tr><td colspan="2">R</td><td>U</td><td>A</td></tr>
<tr><td>I</td><td>Introduction to Internet of Things</td><td>12</td><td rowspan="8">Q4</td><td colspan="2" rowspan="2">Q1</td><td rowspan="2">Q9(a)</td><td rowspan="2">Q13(a)</td></tr>
<tr><td>II</td><td>M2M, IoT System Management with NETCONF-YANG</td><td>13</td></tr>
<tr><td>III</td><td>Elements of IoT</td><td>12</td><td colspan="2" rowspan="2">Q2</td><td rowspan="2">Q10(a)</td><td rowspan="2">Q14(a)</td></tr>
<tr><td>IV</td><td>IoT Application Development</td><td>13</td></tr>
<tr><td>V</td><td>IoT Privacy, Security and Governance</td><td>12</td><td rowspan="2">Q3</td><td>Q5,Q6</td><td>Q9(b),Q11(a), Q11(b)</td><td>Q13(b),Q15(a), Q15(b)</td></tr>
<tr><td>VI</td><td>IIoT and Case Studies on IoT Design</td><td>13</td><td>Q7,Q8</td><td>Q10(b),Q12(a), Q12(b)</td><td>Q14(b),Q16(a), Q16(b)</td></tr>
<tr><td></td><td>Total</td><td>75</td><td colspan="2">8</td><td>8</td><td>8</td></tr>
</table>

Course Contents

UNIT - 1: Introduction to Internet of Things **Duration: 12 Periods (L: 10 – T: 2)**

IoT – Definition, characteristics, Physical design of IoT, Things in IoT, IoT Protocols, Logical Design of IoT, IoT functional blocks, IoT communication Models, IoT communication API's IoT enabling Technologies – Wireless sensor networks, Cloud Computing, Big Data Analytics, Communication protocols, embedded systems. IoT Levels and Deployment templates – IoT Level-1, IoT Level-2, IoT Level-3, IoT Level-4, IoT Level-5, IoT Level-6, Popular IoT platforms, Domain specific IoTs

UNIT - 2: M2M, IoT System Management with NETCONF-YANG

Duration: 13 Periods (L: 11 – T: 2)

M2M, Difference between IoT and M2M, SDN and NFV for IoT, Need for IoT Systems Management, Simple Network Management Protocol, Network Operator requirements, NETCONF, YANG, IoT Systems Management with NETCONG-YANG

UNIT - 3: Elements of IoT **Duration: 12 Periods (L: 10 – T: 2)**

Overview of IoT components-basic building blocks of IoT, Hardware Components- IoT Devices: Raspberry PI, Arduino; Sensors, Actuators, Smart objects and RFID, Software Components- Python Packages of interest for IoT, Networking Protocols

UNIT – 4: IoT Application Development **Duration: 13 Periods (L: 10– T: 3)**

IoT Design Methodology, Linux on Raspberry PI, Raspberry PI interfaces, Programming Raspberry PI with Python, Data storage on cloud/local server

UNIT - 5: IoT Privacy, Security and Governance

Duration: 12 Periods (L: 10– T:2)

Overview of Governance, Security and Privacy issues, Security, Privacy and Trust in IoT, IoT security life cycle, use of Blockchain in IoT security

UNIT - 6: IIoT and Case Studies on IoT Design **Duration: 13 Periods (L: 10 – T:3)**

Industrial Internet of Things (IIoT), Differentiate IoT and IIoT, Case Studies-Home Automation, Urban Cities, Environment, Agriculture, Health Care, Transportation.

Reference Books

1. Internet of Things - A Hands-on Approach, Arshdeep Bahga and Vijay Madisetti, Universities Press, 2015, ISBN: 9788173719547
2. Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD), 2014, ISBN: 9789350239759
3. Dr. SRN Reddy, RachitThukral and Manasi Mishra, “Introduction to Internet of Things: A practical Approach”, ETI Labs
4. Raj Kamal, “Internet of Things: Architecture and Design”, McGraw Hill

Suggested E-learning references

1. https://internetofthingsagenda.techtarget.com/
2. https://dzone.com/iot-developer-tutorials-tools-news-reviews
3. https://blog.bosch-si.com/
4. https://www.hackster.io/
5. https://www.libelium.com/
6. https://www.ibm.com/blogs/internet-of-things/
7. https://azure.microsoft.com/en-us/blog/topics/internet-of-things/
8. https://blog.arduino.cc/
9. https://www.raspberrypi.org/blog/
10. www.lemalabs.com/iot

Suggested Learning Outcomes

For achieving the Course outcomes, the following learning outcomes must be achieved.

CO1: Familiarize with Internet of Things Physical and Logical Design and Levels

1.1 Define IoT and
1.2 Illustrate characteristics of IoT
1.3 Explain Physical Design of IoT
1.4 Explain Logical Design of IoT
1.5 Understand IoT Enabling Technologies
- 1.5.1 Wireless Sensor Networks
- 1.5.2 Cloud Computing
- 1.5.3 Big Data Analytics
- 1.5.4 Communication Protocols
- 1.5.5 Embedded Systems

1.6 Categorize IoT Levels and Deployment templates
- 1.6.1 IoT Level-1
- 1.6.2 IoT Level-2
- 1.6.3 IoT Level-3
- 1.6.4 IoT Level-4
- 1.6.5 IoT Level-5
- 1.6.6 IoT Level-6

1.7 List the various domain areas for application of IoT

CO2: Understand IoT System Management with NETCONF-YANG

2.1 Interpret M2M
2.2 Distinguish between IoT and M2M
2.3 Explain Software Defined Networking (SDN) for IoT
2.4 Explain Network Function Virtualization (NFV) for IoT
2.5 Interpret the need for IoT Systems Management
2.6 Explain Simple Network Management Protocol
2.7 Summarize Network Operator requirements
2.8 Define NETCONF
2.9 Define YANG
2.10 Explain NETCONG-YANG for IoT Systems Management

CO3: Understand Internet of Things, its hardware & software components and Applications.

3.1 Recall the fundamental components of the Internet of Things (IoT)
3.2 Explain the basic building blocks that constitute IoT systems
3.3 Summarize the purpose and significance of Raspberry PI
3.4 Explain the role of Arduino in IoT applications
3.5 Identify various sensors employed in IoT applications
3.6 Classify Actuators
3.7 What are smart objects and explain their role in IoT
3.8 Summarize the use of Radio-Frequency Identification (RFID) in IoT
3.9 Recall Python packages relevant to IoT development
  3.9.1 JSON
  3.9.2 XML
  3.9.3 HTTPLib & URLLib
  3.9.4 SMTPLib
3.10 Identify networking protocols commonly used in IoT

CO4: Interpret IoT Application Development

4.1 What are the key steps of IoT Design Methodology
4.2 Summarize the process of installing and configuring Linux on Raspberry PI
4.3 Identify and explain various interfaces available on Raspberry PI
  4.3.1 Serial
  4.3.2 SPI
  4.3.3 I2C
4.4 Explain steps to interface Raspberry PI components with Python programming.
4.5 Summarize an IoT System using Python for Controlling LED with Raspberry PI
4.6 Explain an IoT System using Python for Interfacing an LED and Switch with Raspberry PI
4.7 Illustrate an IoT System using Python for Interfacing a Light sensor(LDR) with Raspberry PI
4.8 Explain the steps involved in storing data on local and cloud for IoT
4.9 Describe the advantages and challenges of using cloud-based data storage for IoT

CO5: Discuss Security, Privacy and Governance in IoT

5.1 What is the need for Governance in the field of IoT
5.2 What are the key components of governance in the context of IoT
5.3 Illustrate the key aspects of the security, privacy, and trust in IoT environments
5.4 Explain the Privacy issues in IoT
5.5 Explain the Security related issues in IoT
5.6 Differentiate between security and privacy concerns in the context of IoT
5.7 Summarize the ways to build trust in IoT
5.8 Explain the stages of the IoT security life cycle
5.9 Explain the significance of incorporating block chain technology in IoT security

CO6: Explain IIoT and IoT Design Case studies

6.1 Define Industrial Internet of Things (IIoT)
6.2 What are the key characteristics of the Industrial Internet of Things (IIoT)
6.3 Distinguish between the concepts of IoT and IIoT
6.4 Demonstrate a Case Study on Home Automation
6.5 Demonstrate a Case Study on IoT for Urban Cities
6.6 Demonstrate a Case Study on IoT for Environment
6.7 Demonstrate a Case Study on IoT for Agriculture
6.8 Demonstrate a Case Study on IoT for Health Care
6.9 Demonstrate a Case Study on IoT for Transportation.

Suggested Student Activities

Student activity like mini-project, surveys, quizzes, etc. should be done in group of 3-5 students.

- Each group should do any one of the following type activity or any other similar activity related to the course and before conduction, get it approved from concerned course coordinator and programme co-coordinator.
- Each group should conduct different activity and no repeating should occur.

1. Study different IoT's programs and prepare a report.
2. Develop some simple IoT based applications
3. Visit Library to refer to standard Books on IoT concepts, collect related material and prepare notes.
4. Refer to online content and videos to get more knowledge on IoT concepts.
5. Interact with industry people who are working in IoT technologies and prepare a report.
6. Analyze different types of IoT Software's used and submit a report.
7. Write assignments given by course coordinator.
8. Read all the course contents and should be able to write slip tests and surprise tests.
9. Prepare a seminar on a specific topic that is related to latest technologies in the IoT application development and present a Power Point Presentation (PPT) to all the peers.

CO-PO Mapping Matrix

	Basic and Discipline Specific Knowledge	Problem Analysis	Design/Development of Solutions	Engineering Tools, Experimentation and Testing	Engineering Practices Society, Sustainability and Environment	Project Management	Lifelong Learning	Linked PO
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO 7	
CO1	2						1	1,7
CO2	2		1	1			1	1,3,4,7
CO3	2	1	1	1			2	1,2,3,4,7
CO4	2	1	1	1			2	1,2,3,4,7
CO5	3	1			1		2	1,2,5,7
CO6	3	3	2	2	2	1	1	1,2,3,4,5,6,7

MODEL QUESTION PAPERS
STATE BOARD OF TECHNICAL EDUCATION & TRAINING
CS-505A- Internet of Things
V SEMESTER MID-I SEMESTER – I MODEL PAPER

Time: 1 hour **Max. Marks: 20**

PART-A

Answer <u>All</u> questions. Each carries 1 mark. 4X1=04 Marks

1. Define IoT.
2. List IoT Levels.
3. Define YANG.
4. What is M2M?

PART-B

Answer any <u>TWO</u> questions. Each carries 3marks. 2X3=06Marks

5a) List characteristics of IoT.

OR

5b) Why Cloud computing is used in IoT.

6a) Distinguish between IoT and M2M.

OR

6b) List Network Operator requirements in IoT.

PART-C

Answer <u>TWO</u> questions. Each carries 5marks. 2X5=10Marks

7a) Explain Physical Design of IoT.

OR

7b) Explain Level-1 and Level-2 of IoT.

8a) Explain Software Defined Networking (SDN) for IoT.

OR

8b) Explain Simple Network Management Protocol.

STATE BOARD OF TECHNICAL EDUCATION & TRAINING
CS-505A- Internet of Things
V SEMESTER MID SEMESTER – II MODEL PAPER

Time: 1 hour **Max. Marks:20**

PART-A

Answer <u>All</u> questions. Each carries 1 mark. 4X1=04 Marks

1. List fundamental components of the Internet of Things (IoT).
2. What is Actuator?
3. List the steps of IoT Design Methodology.
4. List interfaces available on Raspberry PI.

PART-B

Answer any <u>TWO</u> questions out of Three questions. Each carries 5marks. 2X5=10Marks

5a) List the networking protocols commonly used in IoT.

OR

5b) what is the use of Radio-Frequency Identification (RFID) in IoT.

6a) Write the key steps of IoT Design Methodology.

OR

6b) write the advantages of using cloud-based data storage for IoT.

PART-C

Answer any <u>TWO</u> questions. Each carries 5 marks. 2X5=10Marks

7a) Explain the basic building blocks that constitute IoT systems.

OR

7b) Explain the role of Arduino in IoT applications.

8a) Explain steps to interface Raspberry PI with Python programming.

OR

8b) Explain the steps involved in storing data on local and cloud for IoT.

STATE BOARD OF TECHNICAL EDUCATION & TRAINING
SEMESTER END EXAMINATION MODEL QUESTION PAPER
CS-505A- Internet of Things

Time: 2 hours **Max. Marks:40**

PART-A

Answer All questions. Each carries 2 marks. **1X8=08 Marks**

1. List IoT levels
2. What is meant by smart object?
3. List stages of the IoT security life cycle
4. List Python packages relevant to IoT
5. List key components of governance in IoT
6. List Privacy issues in IoT
7. Define Industrial Internet of Things(IIoT)
8. List key characteristics of IIoT.

PART-B

Answer all questions. Each questions carry 3 marks **3X4=12Marks**

9. a) Distinguish between IoT and M2M.

OR

b) What is the need for Governance in IoT?

10. a) Write the challenges of using cloud-based data storage for IoT.

OR

b) Distinguish between IoT and IIoT.

11 a) How to build trust in IoT.

OR

b) Distinguish between security and privacy in IoT.

12 a) Name three cases where we can use IoT in Cities.

OR

b) Name three cases where we can use IoT in Transportation.

PART-C

ANSWER ALL THE QUESTIONS. EACH QUESTION CARRIES 5 MARKS.

5x4 = 20 M

13a. Explain Logical Design of IoT.

OR

13b. Explain the Security related issues in IoT.

14a. Explain the basic building blocks of IoT.

OR

14b. Analyse the applicaiton of IoT in Environment.

15a. Explain the stages of the IoT security life cycle.

OR

15b. Explain the role of blockchain technology in IoT security.

16a. Analyse the applicaiton of IoT in Ariculture.

OR

16b. Analyse the applicaiton of IoT in Home Automation.

EC-505B : SIGNALS AND SYSTEMS

Course Title:	**Signals and Systems**	Course Code	**EC 505B**
Semester	**V Semester**	Course Group	**Elective**
Teaching Scheme in Periods (L:T:P)	**4:1:0**	Credits	**2.5**
Methodology	**Lecture + Tutorials**	Total Contact Periods	**75**
CIE	**60 Marks**	SEE	**40 Marks**

Pre requisites

Knowledge of Basic Mathematics and

Course Outcomes

Upon completion of the course, the student shall be able to

CO1	Identify Various signals and systems.
CO2	Apply Fourier series on continuous time signals
CO3	Apply Fourier Transform to convert Time domain signals into Frequency domain
CO4	Use the concepts of convolution and correlation
CO5	Analyze the continuous time signals with Laplace Transform
CO6	Analyze the discrete time signals with Z-Transform

Blue Print :

<table>
<tr><th rowspan="2">Unit No</th><th rowspan="2">Unit Name</th><th rowspan="2">Periods</th><th colspan="4">Questions to be set for SEE</th></tr>
<tr><th colspan="2">R</th><th>U</th><th>A</th></tr>
<tr><td>I</td><td>Introduction to Signals and Systems</td><td>13</td><td rowspan="6">Q4</td><td rowspan="2">Q1</td><td rowspan="2">Q9(a)</td><td rowspan="2">Q13(a)</td></tr>
<tr><td>II</td><td>Fourier series</td><td>12</td></tr>
<tr><td>III</td><td>Fourier Transform</td><td>13</td><td rowspan="2">Q2</td><td rowspan="2">Q10(a)</td><td rowspan="2">Q14(a)</td></tr>
<tr><td>IV</td><td>Convolution and Correlation</td><td>12</td></tr>
<tr><td>V</td><td>Laplace Transform</td><td>13</td><td rowspan="2">Q3</td><td>Q5,Q6</td><td>Q9(b),Q11(a), Q11(b)</td><td>Q13(b),Q15(a), Q15(b)</td></tr>
<tr><td>VI</td><td>Z- Transform</td><td>12</td><td>Q7, Q8</td><td>Q10(b), Q12(a), Q12(b)</td><td>Q14(b),Q16(a), Q16(b)</td></tr>
<tr><td></td><td>Total</td><td>75</td><td colspan="2">8</td><td>8</td><td>8</td></tr>
</table>

Course Contents

UNIT - 1: Introduction to Signals and Systems

Duration: 13 Periods (L: 11 – T:2)

Elementary Signals-Graphical representation**.** Classification of Signals: Continuous Time (CT) signals and Discrete Time (DT) signals, Even signals and odd signals, periodic and aperiodic signals, Deterministic signals and random signals. Basic Operations on signals: Addition, subtraction, multiplication, shifting, scaling, reversal. Introduction to Systems. Classification of Systems: Linear and non linear systems, Time Invariant and Time variant systems, Causal and non causal systems, Static and dynamic systems, Stable and unstable systems.

UNIT - 2: FOURIER SERIES **Duration: 12 Periods(L:10 – T:2)**

Fourier series representation of Continuous time periodic signals, convergence of the Fourier series. Properties of continuous time Fourier series: Linearity, Time Shifting, Time Reversal, Time scaling, multiplication, conjugation and conjugate symmetry, parsevals relation for C.T. periodic signals.

UNIT - 3: FOURIER TRANSFORMS: **Duration: 13 Periods(L:11 – T:2)**

Deriving Fourier transform from Fourier series. Convergence of Fourier transform. Fourier transform of periodic signal, Fourier transform of standard signals. Properties of Fourier transform: Linearity, Time shifting, differentiation, integration, Time scaling, frequency scaling, convolution . Inverse Fourier Transform.

UNIT – 4 : CONVOLUTION, CORRELATION OF SIGNALS AND SAMPLING THEOREM. **Duration: 12 Periods (L:10- T:2)**

Concept of convolution in time domain, Cross correlation and auto correlation of functions, properties of correlation function, Energy density spectrum, Parseval's theorem, Power density spectrum, Relation between convolution and correlation. Transfer function of a LTI system. Distortion less transmission through a system.

UNIT - 5: LAPLACE TRANSFORMS: **Duration: 13 Periods(L:11– T:2)**

Introduction of Laplace transform, Region Of Convergence (ROC) of Laplace transform. Laplace Transform of elementary signals. Inverse Laplace transform. Properties of L.T: Linearity, Time shifting, frequency shifting, time scaling, differentiation in time, differentiation in frequency, integration in time, convolution, Initial value and Final value theorems. Relation between L.T and F.T. of a signal. Simple problems on Inverse Laplace Transform.

UNIT - 6: Z–TRANSFORMS: **Duration: 12 Periods(L:10 – T:2)**

Concept of Z-Transform. Region Of Convergence for the Z-Transform. Z-Transform of discrete time signals. Inverse Z- Transform, Properties of Z- transform: Linearity, Time shifting, frequency shifting, scaling in z-domain, differentiation in z domain, convolution, Initial value and Final value theorems

Reference Books

REFERENCE BOOKS:

1. Signals & Systems - Simon Haykin and Van Veen,Wiley, 2nd Edition.
2. Signals & Systems by schaums series publications- 2nd edition
3. Principles of Linear systems and signals by B.P.LATHI.

Suggested Learning Outcomes

Upon completion of the course, the student shall be able to

CO1: Identify Various signals and systems.

1.1 Define signal and system.
1.2 Discuss impulse, unit step , Ramp, signum, Exponential, Sinusoidal signals.
1.3 Classify Signals.
1.4 Explain Continuous Time and Discrete-Time signals.
1.5 Explain Analog and Digital signals.
1.6 Explain Periodic and Aperiodic signals.
1.7 Explain Energy and Power signals.
1.8 Explain Deterministic and Random signals
1.9 Perform operations on Signal (Addition, Subtraction, multiplication, Time shifting, Time scaling and Time Reversal Operations).
1.10 Define Even and Odd functions
1.11 Determine the Even and Odd components of given simple signals
1.12 Classify the various systems.
1.13 Explain Linear and Non Linear systems.
1.14 Explain Time Variant and Time Invariant systems
1.15 Explain Invertible and Non Invertible systems.
1.16 Explain Static and Dynamic systems

CO2: Apply Fourier series on continuous time signals

2.1 Define Trigonometric Fourier series.

2.2 Define Exponential Fourier series.

2.3 Mention Dirichlet's conditions.

2.4 Determine the complex exponential Fourier series co-efficients of the following signals i) $\sin w_0 t$ ii) $\cos w_0 t$ iii) $\sin(at) + \cos(bt)$

2.5 Mention the properties of Fourier series.

2.6 Define half-wave symmetry in Fourier series.

2.7 Determine the exponential Fourier series co efficient of impulse train

2.8 Find the Exponential Fourier series co-efficients of square wave (even and half-wave symmetry) by using time differentiation property.

2.9 Find the Exponential Fourier series co-efficients of square wave (odd and half-wave symmetry) by using time differentiation property.

2.10 Compare Exponential and Trigonometric Fourier series co efficient and write the relation between them.

2.11 Identify Even symmetry, odd symmetry and halfwave symmetry of given signals and find the fourier series coefficients.

2.12 Simple problems on properties of Fourier series.

CO3: Transform time domain signals into Frequency domain

3.1 Define Fourier Transform (F.T).

3.2 Mention the condition for convergence of Fourier Transform.

3.3 Find the F.T. of the following signals.

i) Impulse signal. ii) Exponential signals iii) Rectangular signal.

3.4 Derive the F.T. of unit step signal and signum functiom

3.5 List the properties of F.T.

3.6 State and prove the linearity and time shifting properties of F.T.

3.7 State and prove the Time differentiation and Frequency differention properties of F.T.

3.8 State and prove the convolution property of F.T.

3.9 Find the F.T. of Rectangular signal by using Time differentiation property.

3.10 Find the F.T. of Triangular signal by using Time differentiation property.

3.11 Find the F.T. of Trapezoidal signal by using Time differentiation property.

3.12 Define Inverse Fourier Transform.

CO4: Understand the concept of convolution and correlation

4.1 Define Convolution .

4.2 State the properties of convolution

4.3 Define Auto Correlation.

4.4 Define Cross correlation.

4.5 State and prove parseval's relation.

4.6 Derive the relationship between Auto correlation and Energy Density Spectrum.

4.7 Simple problems on convolution

4.8 Define Power spectral density.

4.9 Write the expression for the relationship between convolution and correlation.

4.10 Define transfer function of a Linear Time Invariant(LTI) system.

4.11 Explain Distortionless transmission through LTI system.

4.12 Mention the conditions for distortion less transmission through LTI systems..

CO5: Analyze the continuous time signals with Laplace Transform

5.1 Define Laplace Transform.

5.2 State the condition for existence of Laplace Transform.

5.3 Find Laplace Transform of the following signals.

Impulse signal. ii) Step signal iii) Exponential signal iv) Sinusoidal signal.

5.4 Define Region of Convergence(ROC).

5.5 Mention the properties of ROC.

5.6 Define Inverse Laplace Transform.

5.7 Solve simple problems on Inverse Laplace Transform.

5.8 List the properties of Laplace Transform.

5.9 State and prove the Linearity and Time shifting properties of L.T.

5.10 State and prove the Time differentiation and Frequency differentiation properties of L.T.

5.11 State and prove the convolution property of L.T.

5.12 State and prove the initial value theorem

5.13 State and Prove the final value theorem

CO6: Analyze the discrete time signals with Z Transform

6.1 Define Z- Transform.

6.2 State the condition for existence of Z- Transform.

6.3 Find Z- Transform of the following signals.

i) Impulse signal $\delta(n)$. ii) Step signal u(n)iii) Exponential signal $a^n u(n)$ iv) Sinusoidal signals[$\sin(w_0 n)u(n)$, $\cos(w_0 n)u(n)$].

6.4 Define Region of Convergence(ROC).

6.5 Mention the properties of ROC.

6.6 Define Inverse Z -Transform.

6.7 Solve simple problems on Inverse Z -Transform.

6.8 List the properties of Z -Transform.

6.9 State and prove the Linearity and Time shifting properties of Z.T.

6.10 State and prove the Time differentiation and Frequency differentiation properties of Z.T.

6.11 State and prove the convolution property of Z.T.

6.12 State and prove the initial value theorem

6.13 State and Prove the final value theorem

CO-PO Mapping Matrix

	Basic and Discipline Specific Knowledge	Problem Analysis	Design/Development of Solutions	Engineering Tools, Experimentation and Testing	Engineering Practices for Society, Sustainability and Environment	Project Management	Lifelong Learning	Linked PO
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO 7	
CO1	2	2		2	1		2	1,2,4,5,7
CO2	3	2	2				1	1,2,3,7
CO3	3	3					1	1,2,7
CO4	2	2					1	1,2,7
CO5	3	2	2				1	1,2,7
CO6	3	2	2				1	1,2,7

STATE BOARD OF TECHNICAL EDUCATION & TRAINING:TS:HYDERABD
EC-505B : SIGNALS AND SYSTEMS

V SEMESTER MID SEM – I MODEL PAPER

Time: 1 hour **Max. Marks:20**

PART-A

Answer <u>All</u> questions. Each carries 1 marks. 4X1=04 Marks

1. Define analog and digital signals.
2. Define static and dynamic systems.
3. List Dirichlet's conditions for Fourier series.
4. Write the relationship between Exponential and trigonometric Fourier series co efficients.

PART-B

Answer any <u>TWO</u> questions. Each carries 3marks. 2X3=06Marks

5a) Determine even and odd components of unit step signal.

OR

5b) Distinguish Linear and non Linear systems.

6a) Determine Exponential Fourier series co-efficients of the signal f(t)= sin (4t) + cos (6t)

OR

6b) Mention the properties of Fourier series.

PART-C

Answer <u>TWO</u> questions. Each carries 5marks. 2X5=10Marks 7 a) Distinguish energy and power signals. Find the energy of the signal $f(t)= e^{-2t} u(t)$

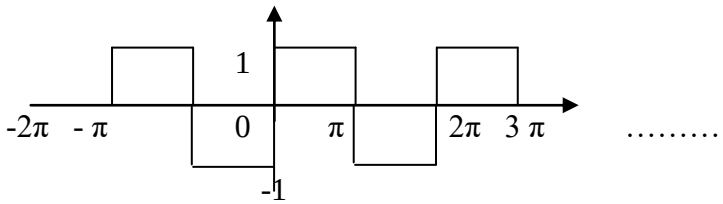
OR

7 b) Define system and Explain Time invariant and Time Variant systems.

8 a) Determine the Exponential Fourier series co-efficiants of impulse train $f(t)= \delta(t- nT_S)$.

OR

8 b) Determine the exponential Fourier series co-efficients of the signal by using differentiation and shifting properties of Fourier series.



STATE BOARD OF TECHNICAL EDUCATION & TRAINING:TS:HYDERABD
EC-505B : SIGNALS AND SYSTEMS

V SEMESTER MID SEMESTER – II MODEL PAPER

Time: 1 hour **Max. Marks:20**

PART-A

Answer <u>All</u> questions. Each carries 1 mark. **4X1=04 Marks**

1. Mention the condition for convergence of Fourier Transform.
2. Define Inverse Fourier Transform.
3. Define Auto correlation.
4. Mention the conditions for distortion less transmission through LTI systems.

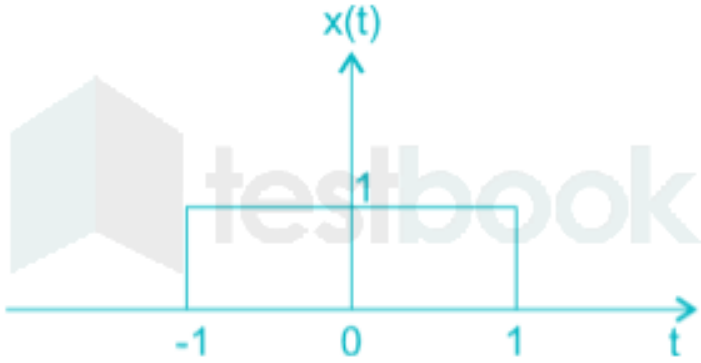
PART-B

Answer any <u>TWO</u> questions out of Three questions. Each carries 5marks.
2X5=10Marks

5a) State and prove the convolution property of F.T.

OR

5 b) Find the F.T. of symmetrical rectangular signal shown in the fig.



6a) Find the convolution of the signals $x(t) = e^{-2t}u(t)$, $h(t) = u(t)$.

OR

6b) Define correlation.Write the expression for the relationship between convolution and correlation.

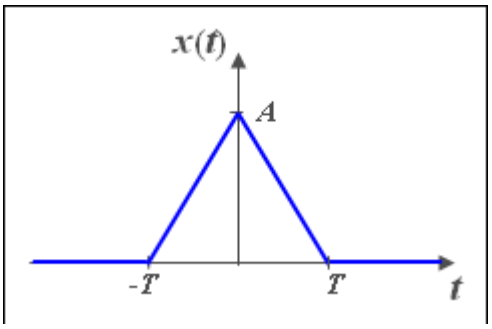
PART-C

Answer any <u>TWO</u> questions. Each carries 5 marks. 2X5=10Marks

7a) State and prove the Time differentiation and Frequency differention properties of F.T.

OR

7b) Find the F.T. of Triangular signal by using Time differentiation property.



8a) Derive the relationship between Auto correlation and Energy Density Spectrum.

OR

8b) Explain Distortionless transmission through LTI system.

STATE BOARD OF TECHNICAL EDUCATION & TRAINING:TS:HYDERABD

SEMESTER END EXAMINATION MODEL QUESTION PAPER

EC-505B : SIGNALS AND SYSTEMS

Time: 2 hours **Max. Marks:40**

PART-A

Answer All questions. Each carries 1 mark. **1X8=08 Mark**

1. Define Even and Odd functions.

2. State any two properties of Fourier Transform.

3. Define Inverse Laplace Transform.

4. Define Trigonometric Fourier series.

5. Define Region of Convergence of Laplace Transform.

6. Find the Laplace Transform of $e^{-3t}u(t)$.

7. State the condition for existance of Z- Transform.

8. Find the Z transform of u[n].

PART-B

Answer all questions. All questions carry 3 marks **4X3=12Marks**

9a) Explain Energy and Power signals.

(OR)

9b) State and prove the initial value theorem.

10a) State and prove time shifting properties of F.T.

(OR)

10b) Find the Z transform of $a^n u(n)$.

11a) Find the Laplace Transform of $e^{-at}u(t)$. Mention the Region of convergence.

(OR)

11b) State and prove the Time differentiation property of L.T.

12a) Find the Z transform of $\sin(w_0 n)u(n)$.

(OR)

12b) State and Prove the final value theorem of Z- Transform.

PART-C

Answer all the questions. Each question carries 5 marks. 5x4 = 20 M

13a) Compare Exponential and Trigonometric Fourier series co efficient and write the relation between them.

(OR)

13b) State and prove the Time differentiation and Frequency differentiation properties of L.T.

14a) State and prove the Time differentiation and Frequency differention properties of F.T.

(OR)

14b) Find the Z Transform of seqence $\cos(w_0 n)u(n)$.

15a) State and prove the initial value and final value theorems of L.T.

(OR)

15b) Find the initial value and final value of $F(S) = 2(S+1)/ S^2+4S+7$.By using Laplace Transform.

16a) State and prove the Linearity and Time shifting properties of Z.T.

(OR)

16b) Find the Z Transform of the following sequences.

i) u[-n-1] ii) a^n u[-n-1]

EC-506A - EMBEDDED SYSTEMS WITH ARDUINO

Course Title:	**Embedded Systems with Arduino**	Course Code:	**EC-506A**
Semester:	**V**	Course Group:	**Elective**
Teaching Scheme in Periods(L:T:P):	**4:1:0**	Credits:	**2.5**
Methodology:	**Lecture + Assignments**	Total Contact Hours:	**75**
CIE:	**60 Marks**	SEE:	**40 Marks**

Pre requisites:

This course requires a basic understanding of microcontrollers, electronics and the concepts of programming using C.

Course Outcomes:

After completion of this course, the student should be able to

CO1 :	Select appropriate Arduino board for various applications.
CO2 :	Develop basic Arduino programs and sketches.
CO3 :	Use the standard Arduino libraries to design suitable applications
CO4:	Interface Sensors and displays to Arduino
CO5 :	Interface actuators and Wifi module to Arduino
CO6 :	Develop various real-time applications using Arduino

Course Content and Blue Print of Marks for SEE

<table>
<tr><th rowspan="2">Unit No</th><th rowspan="2">Unit Name</th><th rowspan="2">Periods</th><th colspan="4">Questions to be set for SEE</th></tr>
<tr><th colspan="2">R</th><th>U</th><th>A</th></tr>
<tr><td>I</td><td>Introduction to Arduino</td><td>10</td><td rowspan="6">Q4</td><td rowspan="2">Q1</td><td rowspan="2">Q9(a)</td><td rowspan="2">Q13(a)</td></tr>
<tr><td>II</td><td>Arduino Software tools and programming</td><td>15</td></tr>
<tr><td>III</td><td>Official Arduino libraries and Simulation Software</td><td>12</td><td rowspan="2">Q2</td><td rowspan="2">Q10(a)</td><td rowspan="2">Q14(a)</td></tr>
<tr><td>IV</td><td>Interfacing of Sensors and displays to Arduino.</td><td>13</td></tr>
<tr><td>V</td><td>Interfacing of actuators and Wifi module to Arduino.</td><td>12</td><td rowspan="2">Q3</td><td>Q5,Q6</td><td>Q9(b),Q11(a), Q11(b)</td><td>Q13(b),Q15(a), Q15(b)</td></tr>
<tr><td>VI</td><td>Real –time applications using Arduino</td><td>13</td><td>Q7,Q8</td><td>Q10(b),Q12(a), Q12(b)</td><td>Q14(b),Q16(a), Q16(b)</td></tr>
<tr><td></td><td>Total</td><td>75</td><td colspan="2">8</td><td>8</td><td>8</td></tr>
</table>

Course Content:

Unit 1: Introduction to Arduino: Duration: 10 Periods (L: 07-T: 03)

Concept of open source hardware - Introduction to Arduino - Advantages of Arduino - ARDUINO Family, Hardware of Arduino UNO3 - Features of Arduino UNO3 - Hardware of Arduino UNO4 - Features of Arduino UNO4

Unit 2: Arduino Software tools and programming Duration: 15 Periods (L: 12-T: 03)

Software tools - The Arduino Integrated Development Environment (Arduino IDE) - Programming of Arduino - Arduino programming vs C programming - Ardunio Language Reference - Variables - Functions -Structures – Basic Arduino programs.

Unit 3: Official Arduino libraries and Simulation Software

Duration: 12 Periods (L: 08 -T: 04)

Arduino Standard libraries – Communication - Data Storage - Device Control - Display - Sensors - Signal - input/output - Timing - Arduino simulators –TinkerCAD and Wokwi Arduino Simulator

Unit 4: Interfacing of Sensors and displays to Arduino. Duration: 13 Periods (L: 10-T: 03)

Introduction to sensors – Interfacing of different sensors such as Humidity, Proximity, IR Motion, Accelerometer, Sound, Light Distance, Pressure, Thermal etc - Reading data from analog and digital sensors on Serial Monitor – interfacing of Seven Segment and LCD displays

Unit 5: Interfacing of actuators and Wifi module to Arduino.

Duration: 12 Periods (L: 08-T: 04)

Introduction to actuators - Functioning of actuator – interface relays and motors to Arduino Board. – Interfacing of wifi module to Ardunio.

Unit 6: Real –time applications using Arduino Duration: 13 Periods (L: 10-T: 03)

Introduction to Real –time applications using Arduino - Arduino based smart house, Street Light system, watering of plants. – Introduction Arduino Cloud – introduction to MIT App inventor.

RECOMMENDED BOOKS

1. Arduino-Based Embedded Systems : By Rajesh Singh, Anita Gehlot, Bhupendra Singh, and Sushabhan Choudhury.
2. Getting Started with Arduino, Book by Massimo Banzi
3. Arduino Made Simple by Ashwin Pajankar
4. Embedded C, Pont, Michael J
5. Become an App Inventor: The Official Guide from MIT App Inventor by Lang Karen

Suggested E-Learning references

1. https://docs.arduino.cc/
2. https://hackr.io/tutorials/learn-arduino
3. https://www.instructables.com/Arduino-Projects/
4. www.nptel.ac.in
5. https://appinventor.mit.edu/explore/get-started

Suggested Learning Outcomes:

After completion of this course, the student should be able to

CO1: Select appropriate Arduino board for various applications.

1.1. Describe concept of open source hardware
1.2. List open source hardware devices
1.3. List the advantages of Arduino.
1.4. Summarize the Arduino family.
1.5. Explain use of Arduino documentation.
1.6. State the features of Ardunio UNO R3
1.7. List technical specifications of Ardunio UNO R3
1.8. Describe pinout of Ardunio UNO R3
1.9. State the features of Ardunio UNO R4 Wifi
1.10. List technical specifications of Ardunio UNO R4 Wifi
1.11. Describe Pin out of Ardunio UNO R4 Wifi
1.12. Compare Ardunio UNO R3 and Ardunio UNO R4 Wifi

CO2: Develop basic Arduino programs and sketches.

2.1. List software tools for Arduino programming.
2.2. Describe Arduino IDE2 (Integrated Development Environment).
2.3. List the requirements for installing Arduino IDE2.
2.4. Summarize the features of Arduino IDE 2
2.5. Summarize steps to install a Board Package in the IDE 2
2.6. List three main parts in Arduino programming language.
2.7. Describe functions in Arduino programming language.
2.8. Describe Digital I/O functions and Analog I/O functions.
2.9. Describe Communication and interrupt functions.
2.10. Describe Constants and data types in Arduino programming language.
2.11. List operators in Arduino programming language.
2.12. List Control structures in Arduino programming language.
2.13. Describe Arduino sketch structure.

2.14. Write a sketch for blinking an LED.

2.15. Write a sketch for turn on/off an LED using a push button.

CO3: Use the standard Arduino libraries to design suitable applications.

3.1. Define Libraries in Arduino programming language

3.2. List the steps to install a Library in Arduino IDE 2

3.3. Categorize Official Arduino Libraries

3.4. Describe Robotics Libraries

3.5. Describe Communication Libraries

3.6. Describe Connectivity Libraries

3.7. Describe Memory Libraries

3.8. Describe LiquidCrystal Libraries

3.9. Describe Audio Libraries

3.10. Write a simple sketches using libraries

3.11. List various Arduino simulation software

3.12. Summarize Tinkercad Circuits

3.13. Summarize Wokwi Arduino Simulator

3.14. Compare Tinkercad Circuits and Wokwi Arduino Simulator

CO4: Interface Sensors and displays to Arduino.

4.1. Define sensor.

4.2. Describe importance of following sensor parameters while selecting a sensor.

- 4.2.1. Operating Range
- 4.2.2. Accuracy
- 4.2.3. Sensitivity
- 4.2.4. Bandwidth
- 4.2.5. Power supply requirements

4.3. Name various sensors modules used with Arduino.

4.4. Interface Seven Segment Display to Arduino with appropriate program.

4.5. Interface LCD to Arduino with appropriate program.

4.6. Interface Temperature sensor to Arduino with appropriate program.

4.7. Interface Humidity sensor to Arduino with appropriate program.

4.8. Interface Ultrasonic sensor to Arduino with appropriate program.

4.9. Interface PIR motion sensor to Arduino with appropriate program.

4.10 Interface Gas sensor to Arduino with appropriate program.

C05: Interface Sensors and actuators to Arduino.

5.1. Define Actuators.

5.2. List types of actuators.

5.3. Interface a relay to Arduino for controlling an AC appliance with appropriate sketch.

5.4. List and compare types of motors used in a Arduino applications.

5.5. List features of L298N motor driver.

5.6. Describe pinout of L298N motor driver.

5.7. Interface a servo motor to Arduino with appropriate program.

5.8. Interface a stepper motor to Arduino with appropriate program.

5.9. Interface a DC motor to Arduino with appropriate program.

5.10. List features of ESP8266 wifi module.

5.11. Describe pinout of ESP8266 wifi module.

5.12. Interface ESP8266 to Arduino wifi module to with appropriate program.

CO6: Develop various real-time applications using Arduino

6.1. List Real Time applications of Arduino

6.2. Comprehend MIT App inventor.

6.3. List the features of MIT App inventor.

6.4. Explain use of MIT App Inventor to Control Arduino.

6.5. Design Arduino based automatic of street lights system.

6.6. Design Arduino based automatic plant irrigating system.

6.7. Design Arduino based smart house.

6.8. Describe the use of Arduino Cloud for IOT applications.

6.9. Describe the features of Arduino Cloud.

6.10. List devices that support Arduino Cloud.

Suggested Student Activities

1. List Arduino boards available in the market.
2. List various sensors and actuators available in the market.
3. List various IOT devices around you
4. Go through the example sketch programs given in Arduino IDE.
5. Simulate various examples listed in Arduino official web site
6. Design simple project using Arduino for your institute.
7. Design a simple project using Arduino for your home.
8. Design automatic college bell using Arduino for your institute.
9. Design a simple android app using MIT app inventor.
10. List advantages and disadvantages of advanced microcontroller boards like RaberryPI, BeagleBone, NodeMCU, Jestson etc., available in the market.

CO-PO MAPPING MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO 7	PSO1	PSO2
CO1	-	-	2	2	-	-	3	-	2
CO2	-	-	3	3	-	-	-	-	3
CO3	-	-	2	2	-	-	-	-	2
CO4	-	-	2	2	-	-	3	2	3
CO5	-	-	2	2	-	-	-	-	3
CO6	-	-	3	3	3	2	3	-	3

State Board of Technical Education and Training, Telangana
Model Question paper
DECE V semester
Mid Semester-I Examination

Course Code: EC-506A **Duration:** 1 hour
Course Name: Arduino Based Embedded Systems **Max.Marks:** 20 Marks

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PART-A

Answer **all** questions, Each Question carries **ONE** mark **4x1 = 4 Marks**

1. List any two open source hardware devices.
2. List any two boards in Arduino family.
3. Sate requirements for installing Arduino IDE2.
4. List three main parts in Arduino programming language.

PART-B

Answer **TWO** questions. Each question carries **THREE** marks **2x3 = 6 Marks**

5(a). List the advantages of Arduino.

(OR)

5(b). State the features of Ardunio UNO R3.

6(a). Summarize the features of Arduino IDE 2.

(OR)

6(b). Describe Arduino sketch structure.

PART-C

Answer **TWO** questions. Each question carries **FIVE** marks **2x5= 10 Marks**

7(a). Describe pinout of Ardunio UNO R3 board.

(OR)

7(b). State the features of Ardunio UNO R4 Wifi board.

8(a). Describe Digital I/O functions and Analog I/O functions.

(OR)

8(b) Write a sketch for turn on/off an LED using a push button.

State Board of Technical Education and Training, Telangana
Model Question paper
DECE V semester
Mid Semester-II Examination

Course Code: EC-506A **Duration:** 1 hour
Course Name: Arduino Based Embedded Systems **Max.Marks:** 20 Marks

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PART-A

Answer **all** questions, Each Question carries **ONE** mark **4x1 = 4 Marks**

1. Define Libraries in Arduino programming language
2. List any 2 Audio Libraries of Arduino.
3. Define sensor.
4. Name any Temperature sensor.

PART-B

Answer **TWO** questions. Each question carries **THREE** marks **2x3 = 6 Marks**

5(a). Categorize Official Arduino Libraries.

(OR)

5(b). Summarize Tinkercad Circuits Simulator.

6(a). Explain any three sensor parameters while selecting a sensor.

(OR)

6(b). Draw circuit diagram for interfacing PIR motion sensor to arduino.

PART-C

Answer **TWO** questions. Each question carries **FIVE** marks **2x5= 10 Marks**

7(a). Describe Communication Libraries of Arduino.

(OR)

7(b). Compare Tinkercad Circuits and Wokwi Arduino Simulator

8(a). Interface LCD to Arduino with appropriate sketch program.

(OR)

8(b) Interface Humidity sensor to Arduino with appropriate sketch program.

State Board of Technical Education and Training,Telangana
Model Question paper
DECE V semester
V Semester End Examination

Course Code: EC-506A **Duration:** 02 hours
Course Name: Arduino Based Embedded Systems **Max.Marks:** 40 Marks

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PART-A

Answer **all** questions. Each Question carries one mark **8x1 = 8 Marks**

1. List any two technical specifications of Ardunio UNO R4 Wifi.
2. Define accuracy of a sensor.
3. List any 2 types of actuators.
4. List any 2 functions in Memory Library of Arduino.
5. Draw pin diagram of ESP8266.
6. List any 2 types of motors used in a Arduino applications.
7. State use of MIT app inventor.
8. List devices that support Arduino Cloud.

PART-B

Answer **FOUR** questions. Each question carries **three** marks. **4 x 3 = 12 Marks**

9(a). List operators in Arduino programming language.

(OR)

9(b). Draw circuit diagram for interfacing relay to Arduino for controlling an AC appliance.

10(a). Draw circuit diagram for interfacing seven segment display to Arduino.

(OR)

10(b). Draw block diagram for automatic plant irrigating system.

11(a). Describe pinout of L298N motor driver.

(OR)

11(b). List features of ESP8266 wifi module.

12(a). Draw block diagram for automatic plant irrigating system.

(OR)

12(b). Describe the features of Arduino Cloud.

PART-C

Answer **FOUR** questions. Each Question carries **FIVE** marks **4 x 5 = 20 Marks**

13(a) Describe Arduino sketch structure and write a sketch for blinking an LED.

(OR)

13(b) Explain interfacing a DC motor to Arduino with appropriate sketch program..

14(a) Explain interfacing Temperature sensor to Arduino with appropriate sketch program.

(OR)

14(b) Design Arduino based automatic of street lights system.

15(a) Explain interfacing ESP8266 to Arduino wifi module to with appropriate sketch program.

(OR)

15(b) Explain interfacing a stepper motor to Arduino with appropriate sketch program.

16(a) Design Arduino based smart house.

(OR)

16(b) Describe the use of Arduino Cloud for IOT applications and explainthe features of Arduino Cloud.

CS 506B- MACHINE LEARNING

Course Title	**Machine Learning**	Course Code	**CS 506B**
Semester	**V Semester**	Course Group	**Elective**
Teaching Scheme in Periods (L:T:P)	**4:1:0**	Credits	**2.5**
Methodology	**Lecture +Tutorials**	Total Contact Periods	**75**
CIE	**60 Marks**	SEE	**40 Marks**

Prerequisites

Basic knowledge of Linear algebra, Calculus, Probability and statistics and programming in python.

Course Outcomes

Upon completion of the course the student shall be able to

CO1	Explain the fundamental principles of data and machine learning.
CO2	Comprehend the linear models in both regression and classification.
CO3	Explain the principles underlying non-linear models for classification.
CO4	Interpret the fundamental principles, Architecture, and working of Neural Networks.
CO5	Interpret the concepts of clustering, dimensionality reduction including their underlying principles and mechanisms.
CO6	Understand the concept of Deep Learning and its Algorithms, Machine Learning Applications.

Course Content and Blue Print of Marks for SEE

<table>
<tr><th rowspan="2">Unit No.</th><th rowspan="2">Unit Name</th><th rowspan="2">Periods</th><th colspan="3">Questions to be set for SEE</th></tr>
<tr><th colspan="2">R</th><th>U</th><th>A</th></tr>
<tr><td>I</td><td>Introduction of Machine Learning</td><td>9</td><td rowspan="6">Q4</td><td rowspan="2">Q1</td><td rowspan="2">Q9(a)</td><td rowspan="2">Q13(a)</td></tr>
<tr><td>II</td><td>Linear Models for Supervised Learning</td><td>16</td></tr>
<tr><td>III</td><td>Decision Trees and Ensemble Methods</td><td>11</td><td rowspan="2">Q2</td><td rowspan="2">Q10(a)</td><td rowspan="2">Q14(a)</td></tr>
<tr><td>IV</td><td>Artificial Neural Networks</td><td>14</td></tr>
<tr><td>V</td><td>Clustering, Dimensionality reduction</td><td>14</td><td rowspan="2">Q3</td><td>Q5, Q6</td><td>Q9(b), Q11(a), Q11(b)</td><td>Q13(b), Q15(a), Q15(b)</td></tr>
<tr><td>VI</td><td>Deep Learning, Machine Learning Applications</td><td>11</td><td>Q7,Q8</td><td>Q10(b), Q12(a), Q12(b)</td><td>Q14(b), Q16(a), Q16(b)</td></tr>
<tr><td colspan="2">Total</td><td>75</td><td colspan="2">8</td><td>8</td><td>8</td></tr>
</table>

Course Contents

UNIT -1: Introduction of Machine Learning: Duration: 9 Periods (L:7 - T:2)

Data- types of data, data preprocessing. Introduction of machine learning: Definition- Applications - Types of machine learning algorithms, Supervised learning: Issues of supervised learning - Working of supervised learning algorithm, Approaches and Algorithms of supervised learning, Application for supervised learning.

UNIT -2: Linear Models for Supervised Learning Duration: 16 Periods (L:13 –T:3)

Linear models for Regression: Linear Regression - Multivariate Linear Regression, Metrics: Mean Absolute Error, Mean Squared Error, R^2 (R-Squared) - L**inear Models for Classification:** Logistic Regression, Naïve Bayes classifier, Metrics: Accuracy, Confusion Matrix, Precision – Recall – F1- Score.

UNIT -3: Decision Trees and Ensemble Methods

Duration: 11 Periods (L:9 –T:2)

Difference between Linear and non-linear models. Decision Trees: Introduction - Decision tree Induction – advantages and disadvantages –Overfitting – Pruning - Ensemble methods- Rationale for ensemble methods - Bagging.

UNIT – 4: Artificial Neural Networks: Duration: 14 Periods (L:12 –T:2)

Perceptron algorithm, Limitations, Neural Network: Introduction, Activation functions, Cost functions, Architecture, Training (learning), Optimization.

UNIT -5 : Clustering, Dimensionality reduction

Duration: 14 Periods (L:12 – T:2)

Clustering- Definition-Advantages-Applications-Clustering- metrics- types- K-Mean clustering–Elbow curve - K-Nearest Neighbor (KNN) - Apriori Algorithm - Curse of dimensionality - Dimensionality reduction techniques

UNIT -6: Deep Learning, Machine Learning Applications Duration: 11 Periods (L:9 – T:2)

Deep Learning: Definition, working of deep learning, Working principle of Various Neural Networks - CNN (Convolutional Neural Networks), LSTM (Long Short term Memory Networks), GAN (Generative Adversarial Nets), Recurrent Neural Networks. Machine Learning Applications: List various machine learning applications, ML in Computer Vision, ML in Natural Language Processing.

Reference Books

1. Pattern Recognition and Machine Learning by Christopher Bishop
2. Introduction to machine Learning by Ethem Alpaydim
3. Introduction to Machine Learning (The Wikipedia Guide)
4. Machine Learning by saikat Dutt and Subramanian ChandraMouli
5. Machine learning, Tom Mitchell, McGrawHill.
6. Data mining by pang Ning Tan, Vipin Kumar, Michael Steinbach
7. Fundamentals of Neural networks --- Laurene Fausett
8. Neural Networks and Deep learning- CharuC.Aggarwal - Springer International Publishing, 2018
9. Neural Networks, A Classroom Approach , Tata McGraw -Hill, 2007 - Satish Kumar
10. Neural Networks, A Comprehensive Foundation, 2nd Edition, Addison Wesley Longman, 2001- Simon Haykin.

Suggested E-learning references

1. http://github.com
2. https://towardsdatascience.com/
3. https://softai.io
4. Part I: The Fundamentals | Introduction to Probability | Supplemental Resources | MIT OpenCourseWare.
5. Statistics and Probability | Khan Academy.
6. www.nptel.com
7. www.swayam.gov.in

Specific Learning Outcomes

For achieving the Course outcomes, the following learning outcomes must be achieved

CO1 : Explain the fundamental principles of data and machine learning

1.1 Define Data
- 1.1.1 List the type of data
- 1.1.2 Define continuous and Discrete Data
- 1.1.3 List Data preprocessing techniques (handling missing values, binning, scaling, transformations).

1.2 Define Machine Learning (ML).
1.3 List the applications of Machine Learning.
1.4 Types of Machine Learning algorithms
- 1.4.1 List various Machine Learning algorithms
- 1.4.2 Define Supervised Learning.
- 1.4.3 List the applications of supervised Learning
- 1.4.4 Define Unsupervised Learning.
- 1.4.5 List the applications of Unsupervised Learning
- 1.4.6 Define Reinforcement Learning
- 1.4.7 List the applications of reinforcement Learning.

1.5 Supervised learning
- 1.5.1 List the issues of supervised learning
- 1.5.2 Working principle of supervised learning algorithm

1.5.3 List the various approaches and algorithms of supervised learning

CO2 : Comprehend the linear models in both regression and classification

2.1 Linear Regression
- 2.1.1 Define Linear Regression
- 2.1.2 List applications of simple Linear regression
- 2.1.3 List advantages and disadvantages of Linear Regression.
- 2.1.4 What is a variable (or Feature)
- 2.1.5 Describe the various types of variables (Dependent and Independent variables)
- 2.1.6 Explain formula of Linear Regression
- 2.1.7 Describe the steps in building the Linear Regression.
- 2.1.8 List the assumptions and Diagnostic of Linear Regression.

2.2 Multivariate Linear Regression:
- 2.2.1 What is the Multivariate Linear Regression?
- 2.2.2 Explain the formula of Multivariate Linear Regression.
- 2.2.3 Explain the point to consider in Multivariate Linear Regression.

2.3 Compare Simple Linear Regression with Multivariate Linear regression.

2.4 Explain Metrics: Mean Absolute Error, Mean Squared Error, R^2 (R-Squared)

2.5 Linear Models for Classification
- 2.5.1 Define Classification
- 2.5.2 List the types of classification
- 2.5.3 List the applications of Classifications
- 2.5.4 List the Algorithms used for Classification
- 2.5.5 Logistic Regressions.
  - 2.5.5.1 Explain the formula for Logistic Regression.
  - 2.5.5.2 Explain the steps in building the Logistic Regression.
  - 2.5.5.3 List and explain the metrics for Classification algorithms (Confusion Matrix, Accuracy, Precision and Recall, F1-Score)

2.6 Naive Bayes Classifier:
- 2.6.1 Define Conditional Probability
- 2.6.2 Illustrate conditional probability with an example
- 2.6.3 What is Bayes Theorem?
- 2.6.4 Explain how Bayes Theorem is used for classification
- 2.6.5 Illustrate Naive Bayes classifier

CO3 : Explain the principles underlying non-linear models for classification

3.1 Define Decision Tree.

3.2 List different type of Nodes in Decision tree (Decision Node, Leaf Node).

3.3 Define Decision node and Leaf node.

3.4 How a Decision Tree works?

3.5 List the steps to build a Decision Tree.

3.6 Outline design Issues of Decision tree Induction.

3.7 Explain different methods for expressing attribute test conditions.

3.8 What is Entropy and Information Gain?

3.9 Illustrate finding the best attribute using Entropy and Information Gain.

3.10 Explain how to calculate Information Gain of a node.

3.11 List Advantages and Disadvantages of Decision Tree.

3.12 Define overfitting.
3.13 Define pruning.
3.14 How to prune decision tree using Pre-pruning (Early stopping rule)?
3.15 How to prune decision tree using Post-pruning (Tree Pruning)?
3.16 Explain ID3 algorithm with an example.
3.17 List advantages and disadvantages of ensemble methods.
3.18 Define Bagging.
3.19 List advantages and Disadvantages of Bagging.
3.20 How Bagging works?

CO4: Interpret the fundamental principles, Architecture, and working of Neural Networks.

4.1 Interpretation of the biological neuron
4.2 Define Perceptron
4.3 Explain Steps in perceptron algorithm.
4.4 List the limitations of perceptron algorithm
4.5 Define Neural Network
4.6 Define Activation function
4.7 List activation functions
4.8 Define Cost functions
4.9 List Cost functions.
4.10 Define Artificial Neural Network.
4.11 Explain Architecture of Artificial Neural Network.
4.12 Define Input Layer
4.13 What is Hidden Layer?
4.14 Define Output Layer
4.15 List the components of Neural Network
4.16 Explain Single layer perceptron
4.17 Explain Multi layer perceptron
4.18 Define Learning
4.19 Define forward propagation
4.20 Explain forward propagation
4.21 Define backward propagation
4.22 Explain backward propagation
4.23 Define Epochs. What is hyper parameter tuning?
4.24 Define Optimization
4.25 List the types of Optimization
4.26 Explain Gradient Descent Optimization
4.27 Explain stochastic Gradient Descent Optimization.

CO5: Interpret the concepts of clustering, dimensionality reduction including their underlying principles and mechanisms.

5.1 Define unsupervised learning.
5.2 Illustrate the working of unsupervised learning.
5.3 Differentiate supervised learning with unsupervised learning.
5.4 List the types of unsupervised learning.
5.5 Outline various unsupervised learning algorithms.
5.6 What is Cluster?
5.7 List Cluster methods.

5.8 List the Applications of Clustering.
5.9 Explain Distance based and Similarity based metrics used in clustering tasks
5.10 Explain K-Means clustering
5.11 Explain Elbow curve
5.12 Illustrate K-Nearest Neighbor (KNN) Clustering algorithm with an example.
5.13 Illustrate Apriori Algorithm with an example.
5.14 Define dimensions. What is curse of dimensionality problem?
5.15 Outline the key problems with curse of dimensionality.
5.16 List the solutions for curse of dimensionality problem.
5.17 Define Dimensionality Reduction.
5.18 List the approaches to Dimensionality Reduction (Feature Selection and Feature Extraction)
5.19 List the commonly used Dimensionality Reduction Techniques.

CO6: Understand the concept of Deep Learning and its Algorithms, Machine Learning Applications.

6.1 Define Deep Learning
6.2 Illustrate how deep learning algorithms work
6.3 List types of algorithms/Networks used in Deep Learning
6.4 Define CNN
6.5 Illustrate working of CNN
6.6 List out the applications of CNN
6.7 Define LSTM
6.8 Illustrate working of LSTM
6.9 List out the applications of LSTM
6.10 Define GAN
6.11 Illustrate working of GAN
6.12 List out the applications of GAN
6.13 Define RNN
6.14 Illustrate working of RNN
6.15 List out the application of RNN
6.16 List out various application areas of Machine Learning
6.17 Define Computer Vision
6.18 Demonstrate how Machine Learning is used in Computer Vision
6.19 Define Natural Language Processing
6.20 Demonstrate how Machine Learning is used in NLP

Suggested Student Activities

Student activity like mini-project, surveys, quizzes, etc. should be done in group of 3-5 students.

- Each group should do any one of the following type activity or any other similar activity related to the course and before conduction, get it approved from concerned course coordinator and programme co-coordinator.
- Each group should conduct different activity and no repeating should occur.

1. Discuss on Kaggle projects
2. Have group Discussion on research paper on machine learning applications

3. Visit Library to refer for standard Books on machine learning and prepare notes.
4. Refer to online content and videos to get more knowledge on concepts.
5. Write assignments given by course coordinator.
6. Read all the course contents and should be able to write slip tests and surprise tests.
7. Prepare a seminar on a specific topic that is related to latest technologies in the machine learning and present a Power Point Presentation (PPT) to all the peers.
8. Prepare quiz on machine learning course related questions and conduct.
9. Participate in Kaggle competitions
10. Develop some projects using machine learning algorithms.

CO-PO Mapping Matrix

	Basic and Discipline Specific Knowledge	Problem Analysis	Design/Development of Solutions	Engineering Tools, Experimentation and Testing	Engineering Practices for Society, Sustainability and Environment	Project Management	Lifelong Learning	Linked PO
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO 7	
CO1	2	1					1	1,2,7
CO2	3	2	1				2	1,2,3,7
CO3	2	2	2				2	1,2,3,7
CO4	3	1					2	1,2,7
CO5	2	2	1				2	1,2,3,7
CO6	2	2	1				1	1,2,3,7

State Board of Technical Education and Training, Telangana
Model Question paper
DCSE V Semester
Mid Semester-I Examination

Course Code: CS-506B **Duration : 1 Hour**
Course Name: Machine Learning **Maximum Marks: 20**

PART-A

Answer **all** questions- Each Question carries **ONE** mark **4x1 = 4 Marks**

1) Define supervised learning.
2) Define reinforcement learning.
3) Define Linear regression.
4) Define Feature.

PART-B

Mark Answer **TWO** questions- Each question carries **THREE** marks **2x3 = 6 Marks**

5(a) Define data and list types of data
(OR)
5(b) List data pre-processing techniques.

6(a) List the assumption of Linear Regression.
(OR)
6(b) List the various classification algorithms.

PART-C

Answer **TWO** questions- Each question carries **FIVE** marks **2x5= 10 Marks**

7(a) Explain various machine learning algorithms.
(OR)
7(b) Explain working principle of supervised learning.

8(a) Explain the points to consider in multi variant Regression.
(OR)
8(b) Explain how naïve bayes classifier works.

State Board of Technical Education and Training, Telangana
Model Question paper
DCSE V Semester
Mid Semester-II Examination

Course Code: CS-506B **Duration : 1 Hour**
Course Name: Machine Learning **Maximum Marks: 20**

PART-A

Answer **all** questions- Each Question carries **ONE** mark **4x1 = 4 Marks**

1) List the measures used in selecting the best split in decision tree.
2) Define Bagging
3) Define perceptron
4) List activation functions.

PART-B

Answer **TWO** questions- Each question carries **THREE** marks **2x3 = 6 Marks**

5(a) Explain design Issues of Decision tree Induction.

(OR)

5(b) List advantages of ensemble methods

6(a) List the various cost functions

(OR)

6(b) List the various layers in architecture of neural networks

PART-C

Answer **TWO** questions- Each question carries **FIVE** marks **2x5= 10 Marks**

7(a) Explain how to build a decision tree.

(OR)

7(b) Explain Bagging.

8(a) Explain the ANN architecture

(OR)

8(b) Explain perceptron algorithm.

State Board of Technical Education and Training, Telangana
Model Question paper
DCSE V semester
Semester End Examination

Course Code: CS-506B **Duration:2 hour**
Course Name: Machine Learning **Max.Marks:40 Marks**

PART-A

Answer ALL questions- Each Question carries ONE mark 8x1 = 8 Marks

1) Define supervised learning
2) Define input layer.
3) Define unstructured data..
4) List various machine learning algorithms.
5) Define clustering
6) Define unsupervised learning.
7) Define Deep Learning.
8) List any Two applications of Machine Learning.

PART-B

Answer **FOUR** questions. Each question carries **three** marks. **4 x 3 = 12 Marks**

9(a) List applications of machine learning.

(OR)

9(b) List cluster methods.

10(a) List disadvantages of ensemble methods.

(OR)

10(b) Describe any two applications of Machine learning.

11a) Write the differences between supervised and unsupervised learning.

(OR)

11(b) Briefly explain curse of dimensionality.

12(a) Illustrate the working of CNN.

(OR)

12(b) Illustrate the working of LSTM.

PART-C

Answer **FOUR** questions. Each Question carries **FIVE** marks **4 x 5 = 20 Marks**

13(a) Explain various issues in supervised learning.

(OR)

13(b) Explain K-means clustering.

14(a) Explain how to select the best split of decision tree.

(OR)

14(b) Illustrate the working of RNN.

15(a) Explain Elbow method in K-means clustering.

(OR)

15(b) Explain applications of clustering.

16(a) Explain How Machine Learning used in Computer Vision.

(OR)

16(b) Explain the working principle of NLP.

EC-507: DIGITAL CIRCUIT DESIGN USING VERILOG HDL LAB

Course Title	Digital C ircuit Design using Verilog HDL Lab	Course Code	EC-507
Semester	V	Course Group	Practical
Teaching Scheme in Periods(LTP)	1:0:2	Credits	1.25
Methodology	Lecture+ Practical	Total Contact Periods	45
CIE	60 Marks	SEE	40 Marks

Pre requisites

1 Concepts of switching theory.
2 Knowledge of Combinational and Sequential Circuits.
3 Basic fundamentals of Programming

Course Outcomes

Upon Completion of the course, student shall be able to

CO1	Design and Test Logic Gates
CO2	Design and Test Combinational Circuits
CO3	Design and Test Sequential Circuits

Course content and Blue Print of marks for Semester End Examination (SEE)

	Unit No	Unit Name	Periods	Questions to be set for SEE		
				R	U	A
I	1	Logic Gates	10			
1.	2	Combinational Circuits	15			
2.	3	Sequential Circuits	20			
		Total	45			

Tools Required:

Xilinx ISE9.2isimulatorandModelsimSoftware.

ELearning Resources:

1.www.nptel.ac.in
2. www.youtube.com
3. https://iisc.talentsprint.com
4.https://www.udemy.com
5.https://www.cadence.com
6. https://www.coursera.org
7.https://learning.intel.com
8.https://maven-sillicon.com

Suggested Learning Outcomes

Upon completion of the course, the student shall be able to

CO1: Design and Test Logic Gates

1.Implement Basic Logic Gates
2. Implement Special Gates
3. Implement Universal Gates

CO2: Design and Test Combinational Circuits

4. Implement Halfadder
5. Implement Full Adder
6. Implement Half Subtractor
7. Implement Full Subtractor
8. Implement4-bitParallel Adder
9. Implement 4x1 Multiplexer
10. Implement 1x4 Demultiplexer
11. Implement 2 to 4 Decoder
12. Implement 4 to 2 Encoder
13. Implement 2-bit Comparator
14. Implement ALU

CO3: Design and Test Sequential Circuits

15. ImplementD -FlipFlop
16. Implement T-Flipflop
17. ImplementS R -FlipFlop
18. Implement JK-Flipflop
19. ImplementSerial In Serial Out(SISO) Shift Register
20. Implement Serial In Parallel Out(SIPO) Shift Register
21. Implement Parallel In Serial Out(PISO) Shift Register
22. Implement Parallel In Parallel Out(PIPO) Shift Register
23. Implement 4-bit Synchronous Up Counter
24. Implement 4-bit Synchronous Down Counter

Suggested Student Activities:

1. Student may implement small Projects such as digital clock,traffic light controller,simple calculator.
2. Students may simulate their designs and use waveform viewers to verify functionality.
3. Student may implement their verilog designs on FPGA boards.
4. Students may integrate multiple verolog modules to create more complex systems like UART.
5. Students can work together on verilog projects, share code and troubleshoot issues.
6. Students can access to online resources such as Verilog Tutorials,text books and forums.
7. Students may organize or participate in Verilog Programming competitions or Hackthons.
8. Students may visit industry and meet the Experts who work with Verilog or Digital design to know the their experiences and insights.

CO-PO Mapping Matrix

	Basic and Discipline Specific Knowledge	Problem Analysis	Design/Development of Solutions	EngineeringTools, Experimentation and Testing	Engineering Practices forSociety, Sustainability and Environment	Project Management	Lifelong Learning	Linked PO
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	
CO1	3	1	1	2				1,2,3,4
CO2	3	2	3	2				1,2,3,4
CO3	3	2	3	2	1			1,2,3,4,5

EC-508 : INDUSTRIAL & POWER ELECTRONICS LAB

Course Title:	Industrial & Power Electronics lab	Course Code :	EC-508
Semester:	V Semester	Course Group :	Practical
Teaching Scheme in Periods(L:T:P):	1:0:2	Credits :	1.25
Methodology :	Lecture+ Practical	Total Contact Periods :	45 Periods
CIE :	60 Marks	SEE :	40 Marks

Pre-requisities:

This course requires the basic knowledge of Industrial & Power Electronics

Course Outcomes

On completion of the course, the student should be able to;

CO1	Analyze characteristics of various power electronic devices
CO2	Illustrate various power control methods and UJT relaxation oscillator
CO3	Analyze characteristics of various types of transducers.

Course Content and Blue Print of Marks for SEE

Unit No	Unit Name	Periods	Questions to be set for SEE		
			R	U	A
1	Analyze characteristics of various power electronic devices	15			
2	Illustrate various power control methods and UJT relaxation oscillator	15			
3	Analyze characteristics of various types of transducers	15			
	Total	45			

Suggested E-learning references

1. http://nptel.ac.in
2. https://www.youtube.com

Suggested Learning Outcomes

Upon completion of the course, the student shall be able to

1. Identify and test using DMM the Power Semiconductor devices SCR, TRIAC, DIAC,, SUS SBS

2. Identify and test using DMM MOSFET, IGBT, LASCR, UJT, OPTO COUPLERS MCT2E, MOC 3011

3. Plot the characteristics of MOSFET and determine gate source threshold voltage

4. Plot the characteristics of SCR and determine Triggering current

5. Plot the characteristics and determine the intrinsic standoff ratio of UJT

6. Construct UJT Relaxation oscillator circuit and observe the output waveforms on CRO
7. Trigger the SCR by UJT and control output Power

8. Plot the characteristics of TRIAC and DIAC

9. Verify that TRIAC can be triggered by positive and negative pulses

10. Implement 100 watt 230V AC Lamp Control circuit using Opto coupler MOC3011 and4 Amps TRIAC.

11. Draw the performance characteristics of LVDT

12. Draw the performance characteristics of RTD

13. Measure the temperature using IC LM 335

14. Implement an ON/OFF temperature controller using IC LM335 Draw the characteristics of Load cell

.

CO-PO Mapping Matrix

	Basic and Discipline Specific Knowledge	Problem Analysis	Design/Development of Solutions	Engineering Tools, Experimentation and Testing	Engineering Practices for Society, Sustainability and Environment	Project Management	Lifelong Learning	Linked PO
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO 7	
CO1	3		2	1		1	3	1,3,4,6,7
CO2	3		2	1		3	3	1,3,4,6,7
CO3	3		2	1		1	3	1,3,4,6,7

EC-509: IOT WITH ARDUINO LAB

CourseTitle	IOT with Arduino Lab	CourseCode	EC-509
Semester	V	CourseGroup	Practical
Teaching Scheme in Hrs (L: T:P)	1:0:2	Credits	1.25
Methodology	Lecture+Practical	Total Contact Hours	45
CIE	60 Marks	SEE	40 Marks

Prerequisites: This course requires a basic understanding of Ardiuno, electronics, Sensors and the concepts of programming using C.

Course Outcomes: Upon completion of the course, the student shall be able to

CO	**Course Outcome**
CO1:	Develop basic Arduino programs
CO2:	Interface Sensors, actuators and displays to Arduino
CO3:	Develop IOT applications using Arduino

Recommended books

1. Arduino-Based Embedded Systems : By Rajesh Singh, Anita Gehlot, Bhupendra Singh, and Sushabhan Choudhury.
2. Getting Started with Arduino, Book by Massimo Banzi
3. Arduino Made Simple by Ashwin Pajankar
4. Embedded C, Pont, Michael J

Suggested e-learning resources

1. https://projecthub.arduino.cc/
2. https://docs.arduino.cc/
3. https://hackr.io/tutorials/learn-arduino
4. https://www.instructables.com/Arduino-Projects/
5. www.nptel.ac.in
6. https://www.tinkercad.com/projects/Basics-of-Arduino-TINKERCAD

Course content and Blue Print of marks for Semester End Examination (SEE)

Unit No	Unit Name	Periods	Questions to be set for SEE		
			R	U	A
1	Basic Arduino Sketches	12	1	1	
2	Arduino Interfacing	24	1	1	
3	IOT applications using Arduino	09			2
	Total	45			

Learning Outcomes:

Upon completion of the course, the student shall be able to:

1. Download and install Latest Arduino IDE
2. Connect an LED to pin 13 and write a sketch to blink it.
3. Connect multiple LEDs to different pins and make them blink alternately.
4. Use PWM to vary LED brightness.
5. Use a push button to toggle an LED.
6. Use an LDR to control LED brightness based on ambient light.
7. Make a buzzer beep at different frequencies.
8. Control the position of a servo motor using Arduino.
9. Connect a TMP36 temperature sensor and display temperature readings.
10. Ultrasonic Distance Measurement: Measure distance using an HC-SR04 ultrasonic sensor.
11. Use a microphone or piezo sensor to detect sound and trigger an LED response
12. Display messages on a 16x2 LCD.
13. Simulate a traffic light using LEDs and control the sequence with code
14. Control the speed and direction of a motor using an L293D motor driver.
15. Serial Communication with Arduino: Send and receive data between Arduino and computer via serial communication.
16. Connect your Arduino to the internet and send sensor data to a cloud platform.

Suggested student Activities:

1. Design simple project using Arduino for your institute.
2. Design a simple project using Arduino for your home.
3. Design automatic college bell using Arduino for your institute.
4. Design a simple android app using MIT app inventor.
5. List advantages and disadvantages of advanced microcontroller boards like RaberryPI, BeagleBone, NodeMCU, Jestson etc., available in the market.

CO-PO/PSO Mapping Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	-	2	2	3	-	-	-	-	3
CO2	-	2	3	3	-	-	-	-	3
CO3	-	2	2	3	2	-	-	-	3

EC-510 - PROJECT WORK

Course Title:	Project Work	Course Code	EC- 510
Semester	V	Course Group	Practical
Teaching Scheme in Periods (L: T: P)	1:0:2	Credits	1.25
Methodology	Lecture + Assignments	Total Contact Hours:	45
CIE	60 Marks	SEE	40 Marks

S. No	SUBJECT	DURATION	ITEMS	MAX MARKS	REMARKS
1	PROJECT WORK	6 Months	1.Project Work I spell (Abstract submission)	25	
			2. Project Work II spell (Final submission)	25	
			3.a) Maintenance of Log Book	15	
			b) Record work	15	
			4.a) Seminar	10	
			b) Viva Voce	10	
TOTAL				100	

The Project shall carry 100 marks and pass marks is 50%. A candidate failing to secure the minimum marks should repeat the Project work.