PAAVAI ENGINEERING COLLEGE, NAMAKKAL - 637 018

(AUTONOMOUS)

B.E - COMPUTER SCIENCE AND ENGINEERING

REGULATIONS 2019

CURRICULUM

(CHOICE BASED CREDIT SYSTEM)

(For the candidates admitted during the academic year 2020-2021)

SEMESTER V

S.No.	Category	Course Code	Course Title	L	T	P	C
Theory							
1.	PC	CS20501	Data Warehousing and Data Mining	3	0	0	3
2.	PC	CS20502	Artificial Intelligence	3	0	0	3
3.	PC	CS20503	Operating Systems	3	0	0	3
4.	PC	CS20504	Object Oriented Modeling and Design	3	0	0	3
5.	PC	CS20505	Cryptography and Network Security	3	0	0	3
6.	PE	CS2015*	Professional Elective Course I	3	0	0	3
Practical							
7.	PC	CS20506	Data Warehousing and Data Mining Laboratory	0	0	4	2
8.	PC	CS20507	Operating Systems Laboratory	0	0	4	2
9.	EE	EN20501	Career Development Laboratory I	0	0	2	1
TOTAL				**18**	**0**	**10**	**23**

SEMESTER VI

S.No.	Category	Course Code	Course Title	L	T	P	C
Theory							
1.	PC	CS20601	Block Chain Technology	3	0	0	3
2.	PC	CS20602	Cloud Computing	3	0	0	3
3.	PC	CS20603	Big Data Analytics	3	0	0	3
4.	PE	CS2025*	Professional Elective Course II	3	0	0	3
5.	OE	CS2090*	Open Elective I	3	0	0	3
Practical							
6.	PC	CS20604	Cloud Computing Laboratory	0	0	4	2
7.	PC	CS20605	Big Data Analytics Laboratory	0	0	4	2
8.	EE	EN20601	Career Development Laboratory II	0	0	2	1
TOTAL				**15**	**0**	**10**	**20**

SEMESTER VII

S.No.	Category	Course Code	Course Title	L	T	P	C
Theory							
1.	HS	BA20151	Entrepreneurship Development	3	0	0	3
2.	PC	CS20701	Internet of Things	3	0	0	3
3.	PE	CS2035*	Professional Elective Course III	3	0	0	3
4.	PE	CS2045*	Professional Elective Course IV	3	0	0	3
5.	OE	CS2090*	Open Elective II	3	0	0	3
Practical							
6.	PC	CS20702	Internet of Things Laboratory	0	0	2	1
7.	EE	CS20703	Mini project	0	0	6	3
			TOTAL	**15**	**0**	**8**	**19**

SEMESTER VIII

S.No.	Category	Course Code	Course Title	L	T	P	C
Theory							
1.	PC	CS20801	Software Project Management	3	0	0	3
2.	PE	CS2055*	Professional Elective Course V	3	0	0	3
3.	PE	CS2065*	Professional Elective Course VI	3	0	0	3
Practical							
4.	EE	CS20802	Project Work	0	0	12	6
			TOTAL	**9**	**0**	**12**	**15**

PROFESSIONAL ELECTIVE COURSES (PE-I)

S.No.	Category	Course Code	Course Title	L	T	P	C
1.	PE	CS20151	Mobile Computing	3	0	0	3
2.	PE	CS20152	Software Quality Assurance	3	0	0	3
3.	PE	CS20153	Cyber Security Essentials	3	0	0	3
4.	PE	CS20154	Soft Computing	3	0	0	3
			TOTAL	**12**	**0**	**0**	**12**

PROFESSIONAL ELECTIVE COURSES (PE-II)

S.No.	Category	Course Code	Course Title	L	T	P	C
1.	PE	CS20251	Component Based Technology	3	0	0	3
2.	PE	CS20252	Wireless Sensor Networks	3	0	0	3
3.	PE	CS20253	Natural Language Processing	3	0	0	3
4.	PE	CS20254	Machine Learning	3	0	0	3
			TOTAL	**12**	**0**	**0**	**12**

PROFESSIONAL ELECTIVE COURSES (PE-III)

S.No.	Category	Course Code	Course Title	L	T	P	C
1.	PE	CS20351	5G Technology	3	0	0	3
2.	PE	CS20352	Search Engine Optimization	3	0	0	3
3.	PE	CS20353	Linear Programming	3	0	0	3
4.	PE	CS20354	Neural Networks and Deep Learning	3	0	0	3
			TOTAL	**12**	**0**	**0**	**12**

PROFESSIONAL ELECTIVE COURSES (PE-IV)

S.No.	Category	Course Code	Course Title	L	T	P	C
1.	PE	CS20451	GPU Computing	3	0	0	3
2.	PE	CS20452	Digital Image Processing	3	0	0	3
3.	PE	CS20453	Cyber Physical Systems	3	0	0	3
4.	PE	CS20454	Decision Support Systems	3	0	0	3
			TOTAL	**12**	**0**	**0**	**12**

PROFESSIONAL ELECTIVE COURSES (PE-V)

S.No.	Category	Course Code	Course Title	L	T	P	C
1.	PE	CS20551	Web and Internet Technologies	3	0	0	3
2.	PE	CS20552	Bio-Inspired Computing	3	0	0	3
3.	PE	CS20553	Software Defined Networks	3	0	0	3
4.	PE	CS20554	Virtual Reality	3	0	0	3
			TOTAL	**12**	**0**	**0**	**12**

PROFESSIONAL ELECTIVE COURSES (PE-VI)

S.No.	Category	Course Code	Course Title	L	T	P	C
1.	PE	CS20651	Multimedia Systems	3	0	0	3
2.	PE	CS20652	Information Retrieval	3	0	0	3
3.	PE	CS20653	Information Visualization	3	0	0	3
4.	PE	CS20654	Knowledge Representation and Reasoning	3	0	0	3
			TOTAL	**12**	**0**	**0**	**12**

OPEN ELECTIVE COURSES (OE-I)

S.No.	Category	Course Code	Course Title	L	T	P	C
1.	OE	CS20901	Database Management Systems	3	0	0	3
2.	OE	CS20902	Introduction to Block Chain Technology	3	0	0	3
			TOTAL	**6**	**0**	**0**	**6**

OPEN ELECTIVE COURSES (OE-II)

S.No.	Category	Course Code	Course Title	L	T	P	C
1.	OE	CS20903	Web Designing	3	0	0	3
2.	OE	CS20904	Android Application Development	3	0	0	3
			TOTAL	**6**	**0**	**0**	**6**

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BA20151 ENTREPRENEURSHIP DEVELOPMENT 3 0 0 3

COURSE OBJECTIVES

To enable students to

- understand the management principles.
- build the entrepreneurial competencies and analyse the support rendered by government and other agencies in entrepreneurship development.
- understand the business opportunities and to prepare a feasibility report.
- propose a business plan.
- appraise and comprehend the various factors to be considered for launching a small business.

UNIT I Basics of Management: 9

Management: Meaning, Definition, Nature and Importance; Roles of management, Functions of Management, Levels of Management, Functional areas of Management: Marketing, Finance, Production, HRM, IT, Research and Development.

The Evolution and Development of Management Thought: Classical, Neo-classical, System and Contingency Approaches, An Overview.

UNIT II Entrepreneurial Competence and Environment 9

Entrepreneurial Competence: Entrepreneurship, Definition, Role and expectations, Entrepreneurial styles and types, Characteristics of the Entrepreneur, Entrepreneurial Competencies, Functions of an Entrepreneur.

Entrepreneurial Environment: Role of Socio-Cultural, Economic and Political Environment. Institutional Support for small entrepreneurs, Assistance Programme for Small Scale Units. Institutional Framework, Central and State Government Industrial Policies and Regulations.

UNIT III Entrepreneurial Development 9

Ownership Structures, Proprietorship, Partnership, Company, Co-operative, Franchise.

Identification of Business Opportunity, Preparation of Feasibility Report, Financial and Technical Evaluation, Project Formulation, Common Errors in Project Formulation, Specimen Project Report, Entrepreneurial Development Programs, Role of SSI Sector in the Economy, IAS Units, Failure, Causes and Preventive Measures, Turnaround Strategies.

UNIT IV Business Plan Preparation, Financing Ventures 9

Business Plan: Business opportunities-SWOT, Business plan process, Feasibility Study, Functional plan, Marketing plan, Operational plan, Organizational plan, financial plan, Evaluation Criteria.

Financing ventures: sources of raising capital, seed funding, venture capital funding, funding opportunities for start-ups in India.

UNIT V Women Entrepreneurship & Entrepreneurship in various sectors 9

Women Entrepreneurship: Growth of women Entrepreneurship, Problems faced by Women Entrepreneurs, Development of women Entrepreneurship.

Entrepreneurship in Informal Sector: Rural Entrepreneurship, Entrepreneurship in Sectors like Agriculture, Tourism, Health care, Transport and allied services.

TOTAL PERIODS: 45

COURSE OUTCOMES

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

- implement the necessary managerial skills to become an entrepreneur.
- take up self-employment having been exposed to entrepreneurial environment.
- select a best business idea by using appropriate methods to assess its viability.
- formulate a business plan and deploy the resources for sustainable growth.
- analyse channels and means of launching a small business in any sector.

TEXT BOOKS

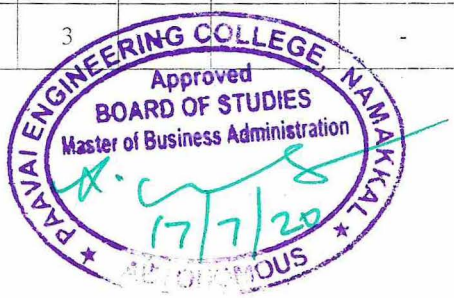
1. Khanka S.S, "Entrepreneurial Development", S. Chand and Company Limited, New Delhi, 2016.
2. Saravanavel. P, "Entrepreneurial Development", Ess Pee Kay Publishing House, Chennai, 2013.

REFERENCES

1. Donald L. Sexton and Raymond W.Smilor, "The Art and Science of Entrepreneurship", Ballinger Publishing Company, 2008.
2. Clifford M.Baumback & Joseph R.Mancuso, "Entrepreneurship and Venture Management", Prentice Hall, 1975.
3. Gifford Pinchot, "Intrapreneuring" Harper & Row Publishers, New York, 2005.
4. Mathew Manimala, "Entrepreneurship Theory at the Crossroads", Paradigms and Praxis, Biztantra, 2nd Edition, 2015.

CO – PO Mapping:

Mapping of Course Outcomes with Programme Outcomes: (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
COs	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	2	-	-	-	-	-	-	-
CO2	-	-	-	-	-	3	-	-	2	-	1	-	-	2
CO3	-	-	2	-	-	-	-	-	-	-	-		1	2
CO4	-	-	-	2	-	-	-	-	-	-	-	-	-	1
CO5	-	-	-	-	-	-	-	2	-	-	3			-



SEMESTER VII

CS20701 **INTERNET OF THINGS** **3 0 0 3**

COURSE OBJECTIVES

To enable students to

- understand the overview of Internet of Things with various design levels and templates.
- describe the generic design methodology for internet of things with python programming.
- analyze the characteristics and applications of domain specific IoTs for real life scenarios.
- know about raspberry pi device and use of cloud platforms and frameworks for developing IoT applications.
- evaluate the approaches for collecting and analyzing data generated by IoT systems in the cloud.

PRE - REQUISITE: Wireless Sensor Networks

UNIT I INTRODUCTION to IoT **9**

Introduction - Definition and Characteristics of IoT, Physical Design of IoT, Logical Design of IoT, IoT Enabling Technologies, IoT Levels and Deployment Templates.

UNIT II DEVELOPING INTERNET OF THINGS **9**

Home Automation - Cities, Environment, Energy, Retail, Logistics, Agriculture, Industry, Health and Lifestyle; IoT and M2M - IoT Protocols, MQTT, CoAP, AMQP.

UNIT III DOMAIN SPECIFIC IoTs **9**

IoT System management - SNMP, Network operator requirements, NETCONF YANG, IoT platform Design Methodology; Case Study on Weather Monitoring, Smart Parking and Air Pollution Monitoring.

UNIT IV IOT PHYSICAL DEVICES, ENDPOINTS, PHYSICAL SERVERS AND CLOUD OFFERINGS **9**

IoT Device - Raspberry Pi-Raspberry Pi Interfaces, Programming Raspberry Pi with Python, Other IoT Devices; Cloud Storage Models and Communication APIs - WAMP, Xively Cloud for IoT, Django, Amazon Web Services for IoT, Sky Net IoT Messaging Platform.

UNIT V DATA ANALYTICS FOR IoT **9**

Introduction - Apache Hadoop, Using Hadoop Map Reduce for Batch Data Analysis; Apache Oozie - Apache Spark, Apache Storm, Using Apache Storm for Real Time Data Analysis; Case Study on Weather Monitoring.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- outline the basic concepts and technologies used in Internet of Things.
- apply the generic design methodology for internet of things with python programming to design the model.
- discuss the different types of domain specific iots for real life applications.
- gain the knowledge of raspberry pi device and its use in cloud platforms and other frameworks for developing iot applications.
- describe the processes of collecting and analyzing data generated by iot systems in the cloud.

TEXT BOOKS

1. ArshdeepBahga, Vijay Madisetti, "Internet of Things - A hands - on approach", Universities Press, 2015.
2. Rolfh. Weber, Romana. Weber, "Internet of Things: Legal Perspectives" Springer, 2010.

REFERENCES

1. Charalampos Doukas, "Building Internet of Things With the Arduino", Volume 1, published by Create space, 2012.
2. Andrian McEwen, Hakim Cassimally, "Designing the Internet of Things", 1st edition, John Wiley & Sons Ltd, 2014.
3. Honbo Zhou, "The Internet of Things in the Cloud: A Middleware Perspective", 1st edition, CRC Press, 2013.
4. Uckelmann, D., Harrison, M., & Michahelles, F. (Eds.). "Architecting the Internet of Things", 2011

CO-PO MAPPING:

Mapping of Course Outcomes with Programme Outcome
(1,2,3 indicates the strength of correlation) 3 - Strong, 2 - Medium, 1 - Weak

CO	Programme Outcomes (POs)												Programme Specific Outcomes (PSOs)	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	1	1	-	-	-	1	-	-	-	2	1
CO2	3	3	3	1	3	-	-	-	1	-	-	1	2	1
CO3	3	3	3	1	3	-	-	-	1	-	1	2	2	1
CO4	3	3	3	1	3	-	-	-	1	-	2	3	2	1
CO5	3	3	3	1	3	-	-	-	1	-	2	3	2	1

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CS20702 **INTERNET OF THINGS LABORATORY** **0 0 2 1**

COURSE OBJECTIVES

To enable the students to

- familiars arduino programming.
- understand IOT programming and Raspberry PI Device .
- use of SQL queries in Raspberry PI.
- implement IOT application using Raspberry PI

LIST OF EXPERIMENTS

1. Sense the Available Networks Using Arduino
2. Measure the Distance Using Ultrasonic Sensor and Make Led Blink Using Arduino
3. Detect the Vibration of an Object Using Arduino
4. Connect with the Available Wi-Fi Using Arduino
5. Sense a Finger When it is Placed on Board Using Arduino
6. Temperature Notification Using Arduino
7. LDR to Vary the Light Intensity of LED Using Arduino
8. MySQL Database Installation in Raspberry Pi
9. SQL Queries by Fetching Data from Database in Raspberry Pi
10. Switch Light on and off Based on the User using Raspberry Pi

TOTAL PERIODS 30

COURSE OUTCOMES

At the end the course, students will be able to

- use IOT device for exchange of data.
- use the programming skills of Raspberry PI.
- develop the cloud platform to analyze and upload sensor data.
- design the applications using Arduino and Raspberry PI.

CO-PO MAPPING:

Mapping of Course Outcomes with Programme Outcome (1,2,3 indicates the strength of correlation) 3 - Strong, 2 - Medium, 1 - Weak														
CO	**Programme Outcomes (POs)**												**Programme Specific Outcomes (PSOs)**	
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	1	1	1	-	-	-	1	-	-	-	2	1
CO2	3	3	3	1	3	-	-	-	1	-	-	1	2	1
CO3	3	3	3	1	3	-	-	-	1	-	1	2	2	1
CO4	3	3	3	1	3	-	-	-	1	-	2	3	2	1

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CS20703 **MINI PROJECT** **0 0 6 3**

COURSE OBJECTIVES

To enable students to

- recognize the significance of proper scope and the problems.
- understand the strategic plans, project prioritization methods and projects.
- understand the importance of scheduling / allocating resources to a project.
- understand the importance of project management as it effects strategy and business success.

GUIDELINES

1. The students are expected to get formed into a team of convenient groups of not more than 3 members on a project.
2. Every project team shall have a guide who is the member of the faculty of the institution. Identification of student group and their faculty guide has to be completed within the first two weeks from the day of beginning of 7th semester
3. The group has to identify and select the problem to be addressed as their project work. make through literature survey and finalize a comprehensive aim and scope of their work to be done.
4. A project report has to be submitted by each student group for their project work.
5. Three reviews have to be conducted by a team of faculty (minimum of 3 and maximum of 5) along with their faculty guide as a member of faculty team (for monitoring the progress of project planning and implementation).

TOTAL PERIODS: 90

COURSE OUTCOMES

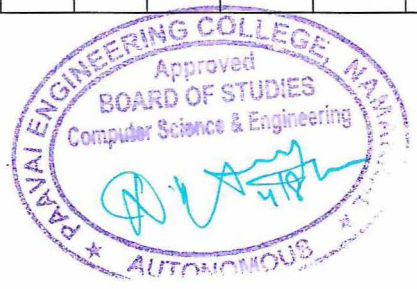
At the end of the course, the students will be able to

- formulate a real-world problem, identify the requirement and develop the design solutions.
- identify technical ideas, strategies and methodologies
- utilize the new tools, algorithms, techniques that contribute to obtain the solution of the project
- test and validate through conformance of the developed prototype and analysis the cost effectiveness.

CO-PO MAPPING:

Mapping of Course Outcomes with Programme Outcome
(1,2,3 indicates the strength of correlation) 3 - Strong, 2 - Medium, 1 - Weak

CO	Programme Outcomes (POs)												Programme Specific Outcomes (PSOs)	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	3	-	-	-	-	-	-	-	1	2	3
CO2	2	3	2	3	-	-	-	-	-	-	-	1	3	3
CO3	3	3	1	3	-	-	-	-	-	-	-	1	2	3
CO4	3	2	3	2	-	-	-	-	-	-	-	1	2	2



SEMESTER VIII

CS20801 SOFTWARE PROJECT MANAGEMENT 3 0 0 3

COURSE OBJECTIVES

To enable students to

- understand the importance of project planning and project evaluation techniques.
- acquire knowledge in software effort estimation and calculating the project duration.
- analyze the risk and allocate the resources.
- gain knowledge about the monitoring and controlling the software projects and its quality.
- learn the fundamental concept of managing people and contracts.

UNIT I INTRODUCTION TO PROJECT PLANNING AND EVALUATION 9

Project Definition - Importance of Software Project Management, Software Projects Vs Other Projects, Activities Covered by SPM, Setting Objectives, Stepwise Project Planning, Cost Benefit Evaluation Techniques.

UNIT II SOFTWARE EFFORT ESTIMATION AND ACTIVITY PLANNING 9

Software Effort Estimation - Agile Methods, Extreme Programming, Scrum, Problems with over and underestimates, Software effort estimation techniques, Bottom-up estimating, Top-down estimating, Estimating by analogy, Albrecht function point analysis; Activity Planning - Objectives of Activity planning, Project Schedules, Project and Activities, Sequencing and Scheduling, Activity on Arrow Networks, Forward Pass, Backward Pass, Identifying Critical Path, Activity Float, Shortening Project Duration.

UNIT III RISK MANAGEMENT AND RESOURCE ALLOCATION 9

Risk Management - Categories of Risk, A Framework for dealing Risk, Risk Identification, Risk Assessment, Risk Planning, Risk Management, Risk Evaluation, Applying the PERT technique; Resource Allocation - The nature of resources, Identifying Resource Requirements, Scheduling Resources, Creating critical paths, counting the cost, Publishing the resource schedule, The Scheduling Sequence.

UNIT IV MONITORING AND CONTROLLING OF PROJECTS AND ITS QUALITY 9

Monitoring and Controlling of Software Projects - Collecting the data, Visualizing Progress, Cost monitoring, Earned value analysis, Prioritizing monitoring; Software Quality - The importance of Software Quality, Software Quality Definition, ISO9126, Product Vs Process Quality Management, Process Capability Models, Techniques to help enhance software quality.

UNIT V MANAGING PEOPLE AND CONTRACTS 9

Managing people - Selection Process, instruction in the best methods; Motivational theories - Maslows Hierarchy of Needs, The Oldham Hackman Job characteristic model, Becoming a Team, Decision Making; Managing Contracts - Types of Contract, Stages in contract placement, Typical terms of a Contract.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- make a stepwise project planning in software project.
- discuss about software effort estimation and activity planning.
- evaluate the risk and allocate the resources accordingly.
- outline the steps in monitoring the progress of project and steps to enhance the quality of project.
- identify the concepts of managing people and contracts.

TEXT BOOKS

1. Bob Hughes, Mikecotterell, "Software Project Management", Fifth edition, TataMcgraw Hill, 2009.
2. Watts s humphrey, "Managing the Software Process", pearson education inc, 2006.

REFERENCES

1. Walker Royce, "Software Project Management", pearson education ,1999.
2. Nina S Godbole, "Software Quality Assurance: Princles and Practise", alpha science international ltd, 2004.
3. Gordon G Schulmeyer," Handbook of Software Quality Assurance", 3rd edition, attech house publishers, 2007.
4. Ramesh, Gopalaswamy, "Managing Global Projects", tatamcgraw hill, 2001.

CO-PO MAPPING:

Mapping of Course Outcomes with Programme Outcome
(1,2,3 indicates the strength of correlation) 3 - Strong, 2 - Medium, 1 - Weak

CO	Programme Outcomes (POs)												Programme Specific Outcomes (PSOs)	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	1	1	1	-	-	1	-	-	-	2	1
CO2	3	3	3	1	3	-	-	-	1	-	-	1	2	1
CO3	3	3	3	1	3	1	-	-	1	-	1	2	2	1
CO4	3	3	3	1	3	1	-	-	1	-	2	3	2	1
CO5	3	3	1	2	2	-	2	-	-	-	2	3	2	1

CS20802 **PROJECT WORK** **0 0 12 6**

COURSE OBJECTIVES

To enable students to

- recognize the significance of proper scope and the problems.
- understand the strategic plans, project prioritization methods and projects.
- understand the importance of scheduling / allocating resources to a project.
- develop strategies for developing and reinforcing high performance teams.

GUIDELINES

1. The students are expected to get formed into a team of convenient groups of not more than 3 members on a project.
2. Every project team shall have a guide who is the member of the faculty of the institution. Identification of student group and their faculty guide has to be completed within the first two weeks from the day of beginning of 7th semester
3. The group has to identify and select the problem to be addressed as their project work. make through literature survey and finalize a comprehensive aim and scope of their work to be done.
4. A project report has to be submitted by each student group for their project work.
5. Three reviews have to be conducted by a team of faculty (minimum of 3 and maximum of 5) along with their faculty guide as a member of faculty team (for monitoring the progress of project planning and implementation).

TOTAL PERIODS: 180

COURSE OUTCOMES

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

- prepare a literature survey in a specific domain as a team / individual to motivate lifelong learning.
- identify the problem by applying acquired knowledge.
- choose efficient tools for designing project modules.
- design engineering solutions to complex problems utilizing a systems approach and combine all the modules for efficient testing.

CO-PO MAPPING:

Mapping of Course Outcomes with Programme Outcome (1,2,3 indicates the strength of correlation) 3 - Strong, 2 - Medium, 1 - Weak														
CO	**Programme Outcomes (POs)**												**Programme Specific Outcomes(PSOs)**	
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	2	2	-	-	-	-	-	-	-	1	2	3
CO2	3	2	2	3	-	-	-	-	-	-	-	1	2	3
CO3	3	2	2	1	-	-	-	-	-	-	-	1	1	2
CO4	3	2	3	2	-	-	-	-	-	-	-	1	2	3

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PROFESSIONAL ELECTIVE COURSES III

CS20351 **5G TECHNOLOGY** **3 0 0 3**

Course Objectives

To enable the students to

- know about the drivers for 5G
- learn the basics of 5G Internet.
- study about the small cells and mobile clouds for 5G
- acquire the knowledge about cognitive radio for 5G wireless networks
- understand the security issues and basics of self-Organizing Network for 5G Communication

UNIT I DRIVERS FOR 5G **9**

Historical trend of wireless communication - Evolution of LTE technology to beyond 4G, 5G roadmap, 10 pillars of 5G, 5G Architecture.

UNIT II THE 5G INTERNET **9**

Internet of Things - Networking Reconfiguration and Virtualization support, Mobility, Quality of Service control, Emerging approach for resource over, provisioning.

UNIT III SMALL CELLS AND MOBILE CLOUDS FOR 5G **9**

Small Cells - WiFi and femtocells, Capacity limits and achievable gains, Mobile data demand, Small cell Challenges; The Mobile cloud - Mobile cloud enablers, Network coding.

UNIT IV COGNITIVE RADIO FOR 5G WIRELESS NETWORKS **9**

Overview of Cognitive Radio technology in 5G wireless - Spectrum optimization using cognitive Radios Spectrum Optimization literature in 5G; Cognitive Radio and Carrier Aggregation - Energy efficient Cognitive Radio technology.

UNIT V SECURITY AND SELF ORGANIZING NETWORK FOR 5G COMMUNICATION **9**

System Architecture - security issues and challenges in 5G communication, SON in UMTS and LTE, Need Forson in 5G; Evolution towards small cell dominant HetNets.

TOTAL PERIODS 45

COURSE OUTCOMES

Upon the completion of the course, the students will be able to

- analyze the drivers for 5G
- describe the basics of 5G Internet.
- elucidate about small cells and mobile clouds for 5G
- synthesize cognitive radio for 5G wireless networks
- identify the security issues and basics of self-Organizing Network for 5Gcommunication

TEXT BOOKS

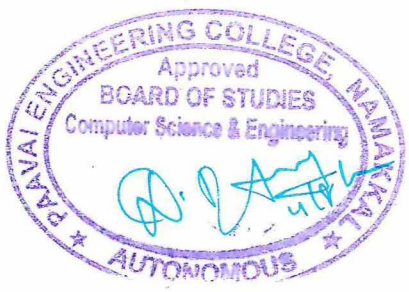
1. Jonathan Rodriguez, "Fundamentals of 5G Mobile Network", John Wiley, First Edition, 2015.
2. Yang- Jing Xu, "5G wireless Systems - Simulation and Evaluation Techniques", Springer, 2015

REFERENCES

1. Sassan Ahmadi, "LTE-Advanced: A Practical Systems Approach to Understanding 3GPP LTE Releases 10 and 11 Radio Access Technologies", 1st Edition, Elsevier.
2. Vincent W.S. Wong, "Key Technologies for 5G Wireless systems", ISBN -13:978-1107172418.
3. Stefan Rommer, Peter Hedman, "5G Core Networks", 2nd Edition, Elsevier, 2019.
4. Christopher Cox, "Introduction to 5G - The New Radio, 5G Network and beyond", 1st Edition Wiley, 2018.

CO-PO MAPPING:

Mapping of Course Outcomes with Programme Outcome (1,2,3 indicates the strength of correlation) 3 - Strong, 2 - Medium, 1 - Weak														
CO	**Programme Outcomes (POs)**												**Programme Specific Outcomes (PSOs)**	
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	-	-	2	2	-	-	-	-	-	-	1	2	1
CO2	3	-	-	2	2	-	-	-	-	-	-	1	2	1
CO3	3	-	-	2	2	-	-	-	-	-	-	1	2	1
CO4	3	-	-	2	2	-	-	-	-	-	-	1	2	1
CO5	3	-	-	2	2	-	-	-	-	-	-	1	2	1



CS20352 **SEARCH ENGINE OPTIMIZATION** **3 0 0 3**

COURSE OBJECTIVE

To enable the students to

- learn the foundational elements of how search engines work.
- familiarize with Search Engine Optimization.
- predict the social media marketing power.
- know about optimizing foundations.
- gain knowledge about Social Tactics with respect to optimization.

UNIT I INTRODUCTION TO SEARCH ENGINE OPTIMIZATION **9**

Semantic Search - Shift to semantic search, How search works, How Semantic Search works, No more Gmes, Semantic Search Preparation checklist, Knowledge Graph; A knowledge Engine rather than a search Engine - How the knowledge Graph Works, Making the Connections; Your Business and the Knowledge Graph - The knowledge Graph Preparation Checklist.

UNIT II SEARCH ENGINE OPTIMIZATION FUNDAMENTALS **9**

Introduction to NEW SEO - How SEO is changing Business practices, Semantic search world, How semantic search is creating new economics, New SEO preparation checklist, Trust and Author Rank; Trust in a semantic web - Creating an identity in a connected world, Trust and Authority, Ranking and Reputation Scores, The Author Rank preparation checklist.

UNIT III SOCIAL MEDIA MARKETING AND SEMANTIC SEARCH **9**

The Social Signal and Its power - Social Media Marketing and Search; How to Make Your Content Go Viral - Context and Relevance in the Semantic Web; The Social Media Marketing Preparation Checklist.

UNIT IV OPTIMIZING FOUNDATIONS **9**

Server Issues - Domain Names, Using Redirects for SEO, Implementing 301 Redirects; Content Management System Troubles - Solving SEO Roadblocks.

UNIT V ADVANCED SOCIAL TACTICS TO OPTIMIZE SEO **9**

Introduction to Advanced Content and Social Tactics to Optimize SEO; Social Media Marketing; Influence Marketing; Creating World Class Content. Google SEO Capstone Project.

TOTAL PERIODS **45**

COURSE OUTCOME

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

- explain the concepts Google Search Engine and Its Algorithms.
- describe the Website performance optimization using Google page speed insights.
- compare and contrast the social media marketing and semantic search.
- identify Metrics to Drive Performance.
- evaluate the Google SEO Capstone Project.

TEXT BOOKS

1. Amerland, David, "Google semantic Search Engine Optimization (SEO) techniques that get your company more traffic, increase brand impact, and amplify your online presence", Que Publishing, 2013.
2. Adam Clarke, "Learn Search Engine Optimization With Smart Internet Marketing Strategies", Digital Book Guru, Publisher, 2016.

REFERENCES

1. Clay, B. and Esparza S, "Search engine optimization all-in-one for dummies", John Wiley & Sons, 2011.
2. Jan Zimmerman and Deborah Ng., "Social Media Marketing all in one dummies", 1st Edition, Elsevierwe, 2017.
3. Dave Evans with Jake Mckee, "Social Media Marketing, The next Generation Of Business Engagement", Wiley Publisher, 2015.
4. S.Axer and K.A.Ribet, "Foundations of Optimization", Springer Publications, 2011.

CO-PO MAPPING:

Mapping of Course Outcomes with Programme Outcome
(1,2,3 indicates the strength of correlation) 3 - Strong, 2 - Medium, 1 - Weak

CO	Programme Outcomes (POs)												Programme Specific Outcomes (PSOs)	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	-	3	2
CO2	3	3	2	1	-	-	-	-	-	-	-	-	3	2
CO3	3	3	2	1	-	-	-	-	-	-	-	-	3	1
CO4	3	2	-	-	1	3	1	-	-	-	-	2	3	2
CO5	3	3	2	1	1	1	1	-	-	-	-	1	3	1

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CS20353 **LINEAR PROGRAMMING** **3 0 0 3**

COURSE OBJECTIVES

To enable the students to

- familiarize with resource management techniques.
- solve dual problems in linear programming.
- know the concepts of integer programming.
- gain knowledge on unconstrained external problems.
- learn the concepts of object scheduling using PERT.

UNIT I INTRODCUTION **9**

Principal components of decision problem Modeling phases; LP Formulation and graphic solution; Resource allocation problems; Simplex method; Sensitivity analysis.

UNIT II DUALITY AND NETWORKS **9**

Definition of dual problem; Primal - Dual relationships; Dual simplex methods; Post optimality analysis - Transportation and assignment model; Shortest route problem.

UNIT III INTEGER PROGRAMMING **9**

Cutting plan algorithm; Branch and bound methods; Multistage (Dynamic) programming

UNIT IV CLASSICAL OPTIMISATION THEORY **9**

Unconstrained external problems, Newton - Ralphson method; Equality constraints; Jacobean methods; Lagrangian method; Kuhn - Tucker conditions; Simple problems.

UNIT V OBJECT SCHEDULING **9**

Network diagram representation; Critical path method; Time charts and resource leveling; PERT

TOTAL PERIODS 45

COURSE OUTCOMES

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

- depict the need of resource management techniques.
- evaluate dual problems in linear programming.
- apply integer programming to problem solving.
- solve simple problems using Newton Raphson, Jacobian, Kuhn tucker methods.
- outline object scheduling methods and apply PERT to problem solving.

TEXT BOOKS

1. H.A.Taha, "Operation Research", Prentice Hall of India, 2002.

2. Kimberly Graves, "CEH: Official Certified Ethical Hacker Review Guide", Wiley, 2007.

REFERENCES

1. Panner Selvam, "Operations Research", Prentice Hall of India, 2002.

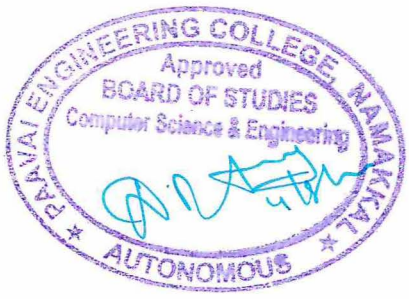
2. Anderson, "Quantitative Methods for business", 8th Edition, Thomas Learning 2002.

3. Winston, "Operation Research" Thomas Learning 2003.

4. David G.Luenberger ,Yinju Ye, "Linear and Nonlinear Programming", Springer, 2015.

CO-PO MAPPING:

Mapping of Course Outcomes with Programme Outcome (1,2,3 indicates the strength of correlation) 3 - Strong, 2 - Medium, 1 - Weak														
CO	**Programme Outcomes (POs)**												**Programme Specific Outcomes (PSOs)**	
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	-	-	-	-	-	-	-	2	2	-	-	2	-	2
CO2	-	-	-	2	-	2	-	1	3	2	1	3	-	2
CO3	-	-	3	2	2	3	2	3	3	1	3	3	2	3
CO4	-	-	3	1	-	2	-	-	1	-	-	3	2	-
CO5	-	-	-	-	-	1	-	-	-	-	-	3	-	-



CS20354 NEURAL NETWORKS AND DEEP LEARNING 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- introduce the foundations of Artificial Neural Networks.
- learn various types of Artificial Neural Networks.
- acquire knowledge on Deep Learning Concepts.
- use an efficient algorithm for Deep learning Models.
- apply optimization strategies for large scale applications.

UNIT I INTRODUCTION TO NEURAL NETWORKS 9

Artificial Neural Networks - Biological Neural Networks, Where and how Neural Nets are Being Used, How Are Neural Networks Used; The McCulloch - Pitts Neuron, Simple neural nets for pattern classification; General discussion - Hebb net, Perceptron, Adaline; Pattern Association - Training Algorithms for Pattern Association, Hetero associative Memory Neural network, auto associative net, iterative auto associative net, Bidirectional Associative memory.

UNIT II NEURAL NETWORK BASED ON COMPETITION 9

Neural network Based on competition - Fixed weight competitive nets, Korhonen self-organizing maps, learning vector quantization, counter propagation; Adaptive Resonance Theory - Introduction, architecture algorithm, applications, analysis; Back Propagation Network - standard backpropagation architecture, algorithm, applications, variations, derivation of learning rules.

UNIT III DEEP NETWORKS 9

Challenges Motivating Deep Learning Algorithm - Deep Networks, Deep Feed, forward networks, Learning XOR, Gradient - Based learning, Hidden Units, Architecture Design, Back-Propagation and Other Differentiation Algorithms.

UNIT IV REGULARIZATION FOR DEEP LEARNING 9

Parameter norm Penalties - Norm Penalties as Constrained Optimization, Regularization and Under Constrained Problems, Dataset Augmentation, Noise Robustness; Semi-Supervised learning - multi-task learning - Early Stopping, Parameter Typing and Parameter Sharing; Sparse Representations - Bagging and other Ensemble Methods, Dropout, Adversarial Training, Tangent Distance, tangent Prop and Manifold, Tangent Classifier.

UNIT V OPTIMIZATION FOR TRAINING DEEP MODELS 9

Challenges in Neural Network Optimization - Basic Algorithms, Parameter Initialization Strategies, Algorithms with Adaptive Learning Rates, Approximate Second Order Methods; Optimization Strategies and Meta - Algorithms Applications, Large-Scale Deep Learning, Computer Vision, Speech Recognition, Natural Language Processing.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- explain about Artificial Neural Networks.
- differentiate various types of Artificial Neural Networks.
- describe Deep Learning basic Concepts.
- elucidate about algorithm for Deep learning Model.
- discuss optimization strategies for large scale application.

TEXT BOOKS

1. Laurene Fausett, "Fundamentals of Neural Networks, Architectures, Algorithms and Applications", 2019, Prentice Hall publications.
2. Michael Nielsen, "Neural Networks and Deep Learning", 2015, Determination Press.

REFERENCES

1. Simon Haykin, "Neural Networks and Learning Machines", 3rd Edition, Pearson Prentice Hall.
2. Ian Goodfellow, Yoshua Bengio, Aaron Courville, "Deep Learning", MIT Press, 2016.
3. Sudharsan Ravichandran, "Hands-On Deep Learning Algorithms with Python", 2019, Edition 2, Packt Publishing.
4. Suresh Samudrala, "Machine Intelligence, Demystifying Machine Learning, Neural Networks and Deep Learning", 2019, Edition 2, Notion Press.

CO-PO MAPPING:

Mapping of Course Outcomes with Programme Outcome
(1,2,3 indicates the strength of correlation) 3 - Strong, 2 - Medium, 1 - Weak

CO	Programme Outcomes (POs)												Programme Specific Outcomes (PSOs)	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	3	2	3	2	2	2	2	2	3	2	3	2
CO2	2	2	3	2	3	2	2	2	2	2	3	2	3	2
CO3	3	2	3	2	3	2	2	2	2	2	3	3	2	3
CO4	2	2	3	2	3	2	2	2	2	2	3	2	2	3
CO5	3	2	3	2	3	2	2	2	2	2	3	2	2	2

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PROFESSIONAL ELECTIVE COURSES IV

CS20451	GPU COMPUTING	3	0	0	3

COURSE OBJECTIVES

To enable students to

- know the basics of GPU Computing.
- understand the concept of memory handling with CUDA.
- acquire knowledge about optimizing different CUDA applications.
- understand about parallel programming issues.
- acquire knowledge about parallel patterns and programming.

UNIT I INTROCUTION 9

History of Super Computing; Understanding Parallelism with GPU - CUDA Hardware Overview, Threads, Blocks, Grids, Warps, Block Scheduling.

UNIT II MEMORY HANDLING 9

Memory Handling with CUDA - Shared memory, Global memory, Constant memory, Texture memory.

UNIT III OPTIMIZING CUDA APPLICATIONS 9

Optimizing CUDA Applications - Problem Decomposition, Memory Considerations, Transfers, Thread Usage, Resource contentions, Self-tuning Applications.

UNIT IV ERROR HANDLING 9

Common problems - Error with CUDA Directives; Parallel programming issues - Algorithmic Issues, Finding and avoiding errors.

UNIT V PARALLEL PATTERNS AND PROGRAMMING 9

Parallel Patterns - Convolution, Prefix Sum, Sparse matrix; Vector Multiplication - Parallel Programming and Computational Thinking, Parallel Programming with OpenACC.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- point out the fundamental concept of parallelism
- discuss the challenges in memory
- able to analyze and optimize different CUDA applications
- describe different parallel programming issues
- evaluate the wireless network flaws and able to apply security patches.

TEXT BOOKS

1. Shane Cook, CUDA Programming: "A Developer's Guide to Parallel Computing with GPUs" (Applications of GPU Computing), I Edition, Morgan Kaufmann, 2013.
2. David B. Kirk, Wen-mei W. Hw, "Programming Massively Parallel Processors - A Hands-on Approach", II Edition, Morgan Kaufmann, 2013.

REFERENCES

1. Nicholas Wilt, "CUDA Handbook: A Comprehensive Guide to GPU Programming", Addison - Wesley, 2013.
2. Jason Sanders, Edward Kandrot, "CUDA by Example: An Introduction to General Purpose GPU Programming", Addison - Wesley, 2010.
3. Dr. Brian Tuomanen, "Hands-On GPU Programming with Python and CUDA:Explore high-performance parallel computing with CUDA", Packt Publishing Limited,2018.
4. Avimanyu Bandyopadhyay, "Hands-On GPU Computing with Python", Packt Publishing

CO-PO MAPPING:

Mapping of Course Outcomes with Programme Outcome
(1,2,3 indicates the strength of correlation) 3 - Strong, 2 - Medium, 1 - Weak

CO	Programme Outcomes (POs)												Programme Specific Outcomes (PSOs)	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	-	2	2	-	-	2	-	2
CO2	-	-	-	2	-	2	-	1	3	2	1	3	-	2
CO3	-	-	3	2	2	3	2	3	3	1	3	3	2	3
CO4	-	-	3	1	-	2	-	-	1	-	-	3	2	-
CO5	-	-	-	-	-	1	-	-	-	-	-	3	-	-

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CS20452 DIGITAL IMAGE PROCESSING 3 0 0 3

COURSE OBJECTIVE

To enable the students to

- familiarize with digital image fundamentals
- use simple image enhancement techniques
- learn concepts of degradation function and restoration techniques.
- identify the image segmentation and representation techniques.
- gain knowledge about image compression

UNIT I DIGITAL IMAGE FUNDAMENTALS AND TRANSFORMS 9

Elements of visual perception; Image sampling and quantization; Basic relationship between pixels; Basic geometric transformations; Introduction to Fourier Transform and DFT - Properties of 2D Fourier Transform.

UNIT II IMAGE ENHANCEMENT TECHNIQUES 9

Basic intensity transformation functions; Histogram processing - Fundamentals of Spatial Filtering, Smoothing spatial filters, Sharpening spatial filters, Image smoothing using frequency domain filters, Image sharpening using frequency domain filters.

UNIT III IMAGE RESTORATION 9

Model of the image degradation / Restoration process; Noise models, Restoration in the presence of noise only, Spatial filtering, Noise reduction by frequency domain filtering, Inverse filtering, Minimum mean square error filtering, Constrained least squares filtering, Geometric mean filter; Image reconstruction from projections.

UNIT IV IMAGE SEGMENTATION AND REPRESENTATION 9

Edge detection; Thresholding; Region Based segmentation - Segmentation by morphological watersheds; Boundary representation; Polygonal approximation using minimum perimeter polygons.

UNIT V IMAGE COMPRESSION 9

Image Compression fundamentals - Huffman coding, LZW coding, Bit plane coding, Predictive coding, Block Transform coding, Wavelet coding.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- understand the Digital image fundamentals and various transforms.
- discuss image enhancement techniques in spatial domain.
- analyze image restoration through various filters.
- understand segmentation and representation based on color.
- describe the basics of compression and various compression algorithms.

TEXT BOOKS

1. Rafael C Gonzalez, Richard E. Woods, "Digital Image Processing", Prentice Hall, 4th Edition, 2018.
2. Anil K. Jain, "Fundamentals of Digital Image Processing", 2nd Edition, Prentice Hall of India.

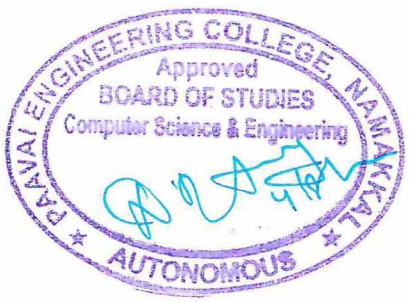
REFERENCES

1. S. Sridhar, "Digital Image Processing", Oxford University Press, 2nd Edition, 2016.
2. Milan Sonka, "Image Processing, analysis and Machine Vision", Thomson Press India Ltd, Fourth Edition, 2012.
3. Rafael C Gonzalez, Richard E. Woods, "Digital Image Processing", Prentice Hall, 3rd Edition, 2008.
4. A.K. Jain, "Fundamentals of Digital Image Processing", Prentice Hall of India, New Delhi, 2011.

CO-PO MAPPING:

Mapping of Course Outcomes with Programme Outcome
(1,2,3 indicates the strength of correlation) 3 - Strong, 2 - Medium, 1 - Weak

CO	Programme Outcomes (POs)												Programme Specific Outcomes (PSOs)	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	3	3	3	3	-	3	2	1	-	3	3	3
CO2	2	-	2	3	3	3	-	3	1	-	-	3	3	2
CO3	1	-	3	2	2	2	-	2	-	-	-	3	3	3
CO4	-	-	3	3	3	3	-	3	1	1	-	3	3	3
CO5	1	-	3	3	3	3	-	3	2	2	-	3	3	3



CS20453 **CYBER PHYSICAL SYSTEMS** 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- understand the basics of cyber physical systems.
- design synchronous models for Real Time applications.
- design Asynchronous models for Real Time applications.
- develop Deep Understanding on selection of hardware and software's for designing dynamical systems.
- design and implement cyber physical system and address the problems and limitations for real world problems.

UNIT I INTRODUCTION TO CYBER PHYSICAL SYSTEMS 9

Introduction To Cyber - Physical Systems, Cyber-Physical Systems Design Recommendations, Cyber - Physical System Requirements; Requirements Engineering, Interoperability, Real Time System - GPU Computing, Internet Of Things (IOT), Radio Frequency Identification Technology; Wireless Sensor Networks Technology, Powerline Communication, Smart Cities And Internet of Everything; Ubiquitous Computing Fundamentals - Core Properties Of Ubiquitous Computing, Smart Devices Components And Services, Autonomous Systems In Ubiquitous Computing; CASE STUDY - Cyber Physical Vehicle Tracking System.

UNIT II SYNCHRONOUS MODEL 9

Reactive Components - Variables, Valuations, And Expression, Execution, Extended, State Machines; Properties of Components - Finite State Components, Combinational Components, Event, Triggered Components, Nondeterministic Components, Input Enabled Components, Task Graphs and Await Dependencies; Composing Components - Block Diagrams Input / Output Variable Renaming, Parallel Composition, Output Hiding; Synchronous Designs - Synchronous Circuits, Cruise Control Systems, Synchronous Networks.

UNIT III ASYNCHRONOUS MODEL 9

Asynchronous Process - States, Internal Actions, Executions, Extended State Machines, Operation on Process; Asynchronous Design Primitives - Blocking Vs Non-Blocking Synchronization, Deadlocks, Shared Memory, Fairness Assumptions; Asynchronous Coordination Protocols - Leader Election, Reliable Transmission, Wait Fee Consensus, Safety Specifications, Invariants of Transition Systems, Safety Monitors.

UNIT IV DYNAMICAL SYSTEM 9

Continuous Time Model - Continuously Evolving Inputs and Outputs, Models with Disturbance, Composing Components Stability; Linear Systems Linearity, Solutions of Linear Differential Equations Stability; Designing Controllers - Open Loop Vs Feedback Controller, Stabilizing Controller, PID Controllers; Analysis Techniques - Numerical Solutions; Barrier Certificates.

UNIT V HYBRID SYSTEMS 9

Hybrid Dynamical Model - Hybrid Process, Process Composition, Zeno Behavior, Stability; Designing Hybrid Systems - Automated Guided Vehicle, Obstacle Avoidance with Multi Robot Coordination, Multi Hop Control Networks, Linear Hybrid Automata, Example Pursuit Game, Formal Model; Symbolic Reachability Analysis; Timed Automata Model of Timed Automata.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- understand the basics of cyber physical systems.
- design synchronous models for Real Time applications.
- design Asynchronous models for Real Time applications.
- develop Deep Understanding on selection of hardware and software's for designing dynamical systems
- come up with cost effective, reliable, robust and feasible designs for real world problems.

TEXT BOOKS

1. Rajeev Alur, "Principles of Cyber Physical Systems", 1st Edition, MIT Press 2015.
2. E. A. Lee and S. A. Seshia, "Introduction to Embedded Systems - A Cyber-Physical Systems Approach", Lulu.com, First Edition, Jan 2013.

REFERENCES

1. Raj Rajkumar, "Cyber Physical Systems", 2nd Edition, Elsevier 2015.
2. Edward D Lamie, "Computing Fundamentals Of Cyber Physical Systems", 2nd Edition, Newnes Elsevier Publication.
3. Sang C.Suh , U.JohnTanik and John N.Carbone, "Applied Cyber-Physical systems Springer", 2014.
4. Hespanha, Joao P, "Linear systems theory", Princeton university press, 2009.

CO-PO MAPPING:

CO/PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
COs	Programme Outcomes (POs)												Programme Specific Outcomes (PSOs)	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO 2
CO1	3	3	3	3	3	3	-	3	3	3	3	3	3	3
CO2	3	3	3	2	3	3	2	3	2	2	2	3	3	2
CO3	2	3	3	3	3	3	-	3	3	3	3	3	3	3
CO4	2	3	2	3	2	2	1	2	3	2	3	2	2	3
CO5	3	3	3	3	3	3	-	3	2	3	2	3	3	3

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CS20454 **DECISION SUPPORT SYSTEMS** **3 0 0 3**

COURSE OBJECTIVES

To enable the students to

- familiarize of the concepts of decision support systems.
- know benefits of model base management.
- describe dialogue management subsystems and its concepts.
- know the relation between DSS and other information systems.
- gain awareness and importance development of MSS.

UNIT I DECISION SUPPORT SYSTEMS AND DATABASE MODELS AND SYSTEMS **9**

Introduction - Subsystems in DSS, Computer Hardware for DSS, Group Decision Support Systems, Information Characteristics; Pre-Database Systems - Database models, Database Languages, Data Dictionary, Database Administrator.

UNIT II MODEL BASE MANAGEMENT SUBSYSTEM **9**

Representation of Models - Benefits of Modelling a Problem, Stages in Model Development, Classification of Models, Computer Software for DSS Models.

UNIT III DIALOGUE MANAGEMENT SUBSYSTEMS AND TECHNOLOGIES FOR DSS **9**

Classification of Users - Major Factors, Interface Styles, Storage Technologies, Advancements in Output Devices, New Directions in Computing.

UNIT IV BUSINESS INTELLIGENCE **9**

The Nature and Sources of Data - Data Collection, Problems and Quality, Database Management Systems in DSS, Database Organization and Structure, Data Warehousing, Datamarts; Business Intelligence - Online Analytical Processing (OLAP), Datamining.

UNIT V IMPACTS OF MSS **9**

Overview - Impacts on Organization, Individuals, Decision Making and the Manager's Job, Issues of Legality, Privacy and Ethics; Intelligent Systems and Employment Levels - Internet Communities, Other Societal Impacts and the Digital Divide, The Future of Management Support Systems.

TOTAL HOURS **45**

COURSE OUTCOMES

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

- state the need of decision support systems.
- list the benefits of model base management.
- discuss the dialogue management subsystems and its concepts.
- relate DSS and other information systems.
- identify importance and development of MSS.

TEXT BOOKS

1. Janakiraman V.S. and Sarukesi K., "Decision Support Systems", 1st Edition, Prentice Hall of India, 2009.
2. Efraim Turban and Jay E. Aronson, "Decision Support System and Intelligent Systems", 7th Edition, Prentice Hall International, 2007.

REFERENCES

1. Taylor, J., "Decision Management Systems", A Practical Guide to Using Business Rules and Predictive Analytics, IBM Press, 2011.
2. Sauter, V., "Decision Support Systems for Business Intelligence", 2nd Edition, John Wiley & Sons, 2011.
3. Burstein, F, Holsapple C.W., "Handbook on Decision Support System 1", Springer, Freda Burstein, 2008.
4. Daniel J. Power, "Decision Support Systems", Quorum books, West port, London, 2002.

CO-PO MAPPING:

Mapping of Course Outcomes with Programme Outcome (1,2,3 indicates the strength of correlation) 3 - Strong, 2 - Medium, 1 - Weak														
CO	Programme Outcomes (POs)												Programme Specific Outcomes (PSOs)	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
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CO3	3	3	3	1	3	-	-	-	1	-	1	2	2	1
CO4	3	3	3	1	3	-	-	-	1	-	2	3	2	1
CO5	3	3	3	1	3	-	-	-	1	-	2	3	2	1

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PROFESSIONAL ELECTIVE COURSES V

CS20551 WEB AND INTERNET TECHNOLOGIES 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- analyze the basic concepts of web programming and internet protocols.
- know how to design interactive web pages using Scripting languages.
- learn server-side programming using servlets.
- develop web pages using XML/XSLT.
- develop application using recent environment like Node JS

UNIT I WEB SITE BASICS AND WEB DESIGNING 9

Web Essentials - Clients, Servers, and Communication; The Internet - Basic Internet Protocols, The World Wide Web, HTTP request message, response message, Web Clients Web Servers; Markup Languages - XHTML; An Introduction to HTML History - Versions, Basic XHTML Syntax and Semantics; Some Fundamental HTML Elements - Relative URLs , Lists-tables, Frames-Forms.

UNIT II CLIENT SIDE PROCESSING AND SCRIPTING 9

Client-Side Processing - The JavaScript Language, History and Versions; Introduction - JavaScript in Perspective, Basic Syntax, Variables and Data Types; Statements - Operators, Literals, Functions, Objects Arrays, Built-in Objects, JavaScript Debuggers.

UNIT III SERVER SIDE PROCESSING AND SCRIPTING 9

Server-Side Processing - Java Servlets; Architecture Overview - Servlet Generating Dynamic Content, Life Cycle, Parameter, Data, Sessions, Cookies; URL Rewriting - Other Capabilities, Data Storage, Servlets and Concurrency.

UNIT IV JSP AND XML 9

Separating Programming and Presentation - JSP Technology, Introduction JSP and Servlets, Running JSP; Applications - Basic JSP, JavaBeans Classes and JSP, Tag Libraries and Files, Support for the Model View - Controller Paradigm; Representing Web Data - XML Documents and Vocabularies, Versions and Declaration, Namespaces; DOM based XML processing - Event oriented Parsing; SAX - Transforming XML Documents - Selecting XML Data; XPATH - Template based Transformations; XSLT - Displaying XML Documents in Browsers.

UNIT V APPLICATION DEVELOPMENT USING NODE JS 9

Introduction to Node.js - Installing Node.js, Using Events, Listeners, Timers, Callbacks in Node.js; Introduction to Mongo DB, Accessing MongoDB from Node.js.

TOTAL PERIODS 45

COURSE OUTCOMES

At the end of the course, the student should be able to:

- design simple web pages using markup languages like HTML and XHTML.
- create dynamic web pages using java script that is easy to navigate and use.
- program server-side web pages that have to process request from client-side web pages.
- represent web data using XML and develop web pages using JSP.
- create Web and Internet application using Node JS.

TEXT BOOK

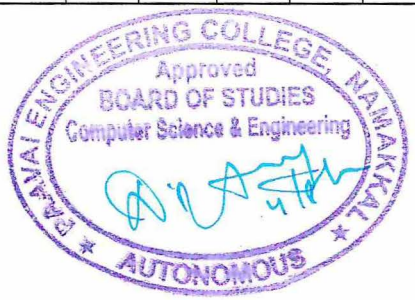
1. Jeffrey C. Jackson, "Web Technologies--A Computer Science Perspective", Pearson Education, 2006.
2. Brad Dayley, Brendan Dayley, and Caleb Dayley, "Node.js, MongoDB and Angular Web Development: The definitive guide to using the MEAN stack to build web applications", 2nd Edition, Pearson Education, 2018.

REFERENCES

1. Robert. W. Sebesta, "Programming the World Wide Web", Fourth Edition, Pearson Education, 2007.
2. Deitel, Goldberg, "Internet & World Wide Web How To Program", Third Edition, Pearson Education, 2006.
3. Marty Hall and Larry Brow, "Core Web Programming", Second Edition, Volume I and II, Pearson Education, 2001, Bates, Developing Web Applications, Wiley, 2006.
4. Ethan Brown , "Web Development with node and express", Orelly Education, 2014.

CO-PO MAPPING:

Mapping of Course Outcomes with Programme Outcome (1,2,3 indicates the strength of correlation) 3 - Strong, 2 - Medium, 1 - Weak														
CO	Programme Outcomes (POs)												Programme Specific Outcomes (PSOs)	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	1	1	-	-	-	1	-	-	-	2	1
CO2	3	3	3	1	3	-	-	-	1	-	-	1	2	1
CO3	3	3	3	1	3	-	-	-	1	-	1	2	2	1
CO4	3	3	3	1	3	-	-	-	1	-	2	3	2	1
CO5	3	3	3	1	3	-	-	-	1	-	2	3	2	1



CS20552	BIO-INSPIRED COMPUTING	3	0	0	3

COURSE OBJECTIVES

To enable the students to

- learn bio-inspired theorems and algorithms.
- understand random walk and simulated annealing.
- learn genetic algorithm and differential evolution.
- study swarm optimization and ant colony for feature selection.
- know about the bio-inspired application in image processing.

UNIT I INTRODUCTION 9

Introduction to algorithm - Newton's method - optimization algorithm - No-Free-Lunch Theorems - Nature-Inspired Mata heuristics - Analysis of Algorithms -Nature Inspires Algorithms - Parameter tuning and parameter control.

UNIT II RANDOM WALK AND ANEALING 9

Random variables - Isotropic random walks - Levy distribution and flights - Markov chains - step sizes and search efficiency - Modality and intermittent search strategy - importance of randomization- Eagle Strategy-Annealing and Boltzmann Distribution - parameters -SA algorithm - Stochastic Tunnelling.

UNIT III GENETIC ALOGORITHMS AND DIFFERENTIAL EVOLUTION 9

Introduction to genetic algorithms and - role of genetic operators - choice of parameters - GA variants - schema theorem - convergence analysis - introduction to differential evolution - variants - choice of parameters - convergence analysis - implementation.

UNIT IV SWARM OPTIMIZATION AND FIREFLY ALGORITHM 9

Swarm intelligence - PSO algorithm - accelerated PSO - implementation - convergence analysis - binary PSO - The Firefly algorithm - algorithm analysis - implementation - variants- Ant colony optimization toward feature selection.

UNIT V APPLICATION IN IMAGE PROCESSING 9

Bio-Inspired Computation and its Applications in Image Processing - An Overview, Fine, Tuning Enhanced Probabilistic Neural Networks Using Meta-heuristic, driven Optimization, Fine, Tuning Deep Belief Networks using Cuckoo Search , Mobile Object Tracking Using Cuckoo Search.

TOTAL PERIODS **45**

COURSE OUTCOMES

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

- describe bio-inspired theorems and algorithms.
- demonstrate random walk and simulated annealing.
- apply genetic algorithms for simple problems.
- illustrate swarm optimization and ant colony for feature selection.
- discuss bio-inspired application in image processing.

TEXT BOOKS

1. Xin-She Yang, "Nature Inspired Optimization Algorithm", Elsevier First Edition 2014.
2. Xin-She Yang, Jaao Paulo papa, "Bio-Inspired Computing and Applications in Image Processing", Elsevier 2016.

REFERENCES

1. Yang, Cui, XIao, Gandomi, Karamanoglu, "Swarm Intelligence and Bio-Inspired Computing", Elsevier First Edition 2013.
2. Eiben, A.E., Smith, James E, "Introduction to Evolutionary Computing", Springer 2015.
3. Helio J.C. Barbosa, "Ant Colony Optimization - Techniques and Applications", Intech 2013.
4. Floreano.D and Mattiussi.C, "Bio-Inspired Artificial Intelligence: Theories, Methods, and Technologies", MIT Press, Cambridge, MA, 2008.

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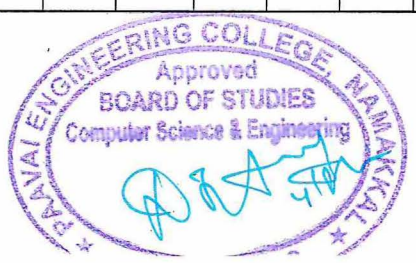
CO2	1	2	-	2	-	2	-	1	2	2	1	1	-	2
CO3	-	1	2	2	2	2	2	3	2	1	3	1	2	3
CO4	1	-	2	1	-	2	-	-	1	-	-	1	2	-
CO5	-	1	1	2	-	1	-	-	2	-	-	2	-	-



CS20553 **SOFTWARE DEFINED NETWORKS** **3 0 0 3**

COURSE OBJECTIVES

To enable the students to

- know about the working of Software defined networks.
- study about the SDN controllers.
- learn the fundamentals of software defined networks protocols.
- understand the SDN programming concepts.
- gain knowledge about the Juniper SDN framework.

UNIT I INTRODUCTION **9**

History of Software Defined Networking (SDN) - Modern Data Center, Traditional Switch Architecture, Why SDN, Evolution of SDN, How SDN Works, Centralized and Distributed Control and Date Planes.

UNIT II OPEN FLOW & SDN CONTROLLERS **10**

Open Flow Specification - Drawbacks of Open SDN, SDN via APIs, SDN via Hypervisor; 111 Based Overlays; SDN via Opening up the Device; SDN Controllers; General Concepts.

UNIT III SDN PROTOCOLS **9**

SDN Protocol specifications, Border Gateway Protocol (BGP); Cisco Application Centric Infrastructure (ACI); OpenFlow - OpenFlow versions, Components of an OpenFlow Switch, Flow and group tables, Rule matching, Action handling, Table misses, Counters, metering and metadata.

UNIT IV SDN PROGRAMMING **9**

Programming SDNs - Northbound Application Programming Interface , Current Languages and Tools; Composition of SDNs ; Network Functions Virtualization (NFV) and Software Defined Networks - Concepts Implementation and Applications.

UNIT V JUNIPER SDN FRAMEWORK **8**

Juniper SDN Framework; IETF SDN Framework; Open Daylight Controller; Floodlight Controller; Bandwidth Calendaring; Data Center Orchestration.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- describe the working of Software defined networks.
- state the working of SDN controllers.
- discuss on software defined networks protocols.
- illustrate the SDN programming concepts.
- explain about the Juniper SDN framework.

TEXT BOOKS

1. Paul Goransson and Chuck Black, "Software Defined Networks: A Comprehensive Approach", First Edition, Morgan Kaufmann, 2014.
2. Thomas D. Nadeau, Ken Gray, "Software Defined Networks", O'Reilly Media, 2013.

REFERENCES

1. Siamak Azodolmolky, "Software Defined Networking with Open Flow", Packet Publishing, 2013.
2. Harvey M. Deital, "Operating Systems", Third Edition, Pearson Education, 2007. Vivek Tiwari, SDN and Open Flow for Beginnersll, Amazon Digital Services, Inc., 2013.
3. Fei Hu, Editor, "Network Innovation through Open Flow and SDN: Principles and Design", CRC Press, 2014.
4. Jim Doherty, "A Visual Guide to Understanding Software Defined Networks and Network Function Virtualization", Addison-Wesley, 2016.

CO-PO MAPPING:

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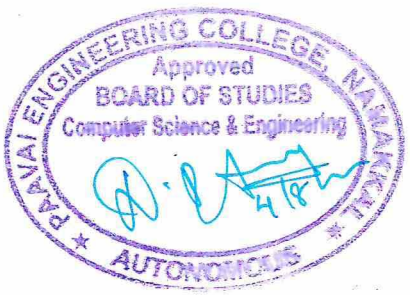
CO1	3	3	1	1	1	-	-	-	1	-	-	-	2	1
CO2	3	3	3	1	3	-	-	-	1	-	-	1	2	1
CO3	3	3	3	1	3	-	-	-	1	-	1	2	2	1
CO4	3	3	3	1	3	-	-	-	1	-	2	3	2	1
CO5	3	3	3	1	3	-	-	-	1	-	2	3	2	1



CS20554 VIRTUAL REALITY 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- learn the fundamental aspects and principles of virtual reality technologies.
- know about the graphical processing units and their architectures.
- acquire knowledge on development process in Virtual environment.
- gain insights of VR programming.
- identify various virtual reality-based applications.

UNIT I INTRODUCTION 9

The three I's of virtual reality - commercial VR technology and the five classic components of a VR system; Input Devices (Trackers, Navigation, and Gesture Interfaces) - Three-dimensional position trackers, navigation and manipulation, interfaces and gesture interfaces; Output Devices; Graphics displays; sound displays and haptic feedback.

UNIT II COMPUTING ARCHITECTURES FOR VR 9

Computing Architectures for VR - The Rendering Pipeline, PC Graphics Architecture, Workstation-Based Architectures, Distributed VR Architectures.

UNIT III VR DEVELOPMENT PROCESS 9

Modelling - Geometric modeling, kinematics modeling, physical modeling, behavior modeling, model Management.

UNIT IV VR PROGRAMMING 9

VR Programming - Toolkits and Scene Graphs, World Toolkit, Java 3D, General Haptics Open Software Toolkit, Peopelshop.

UNIT V VR APPLICATIONS 9

VR Applications - Medical Applications of VR, Education, Arts, and Entertainment, Military VR Applications , VR Applications in Manufacturing , Applications of VR in Robotics.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- describe the fundamental aspects and principles of virtual reality technologies.
- outline the graphical processing units and their architectures.
- illustrate development process in Virtual environment.
- demonstrate simple VR programming.
- summarize virtual reality-based applications

TEXT BOOKS

1. C. Burdea & Philippe Coiffet, "Virtual Reality Technology", Second Edition, Gregory, John Wiley & Sons, Inc., 2008.
2. Tony Parisi ,"Learning Virtual Reality: Developing Immersive Experiences and Applications for Desktop, Web, and Mobile ", O'Reilly Media; 1 edition, 2015

REFERENCES

1. Benford, S., Giannachi G., "Performing Mixed Reality", MIT Press, 2011.
2. Charles Palmer, John Williamson, "Virtual Reality Blueprints: Create Compelling VR Experiences for Mobile", Packt Publisher, 2018.
3. John Vince, "Introduction to Virtual Reality", Springer-Verlag, 2004.
4. William R. Sherman, Alan B. Craig, "Understanding Virtual Reality - Interface, Application, Design", Morgan Kaufmann, 2003

CO-PO MAPPING:

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CO1	1	1	1	-	1	-	-	-	-	1	-	2	1	3
CO2	1	2	2	2	1	-	-	-	2	2	1	1	1	3
CO3	1	1	2	2	3	-	-	-	2	1	3	2	2	3
CO4	1	1	2	2	3	-	-	-	1	-	-	2	2	3
CO5	1	1	1	2	3	-	-	-	2	-	-	2	1	3

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PROFESSIONAL ELECTIVE COURSE VI

CS20651 **MULTIMEDIA SYSTEMS** **3 0 0 3**

COURSE OBJECTIVES

To enable the students to

- know about Multimedia systems basics.
- acquire knowledge about multimedia Tools and authoring.
- interpret about multimedia data compression techniques.
- gain knowledge on multimedia communication systems and protocols.
- enlist multimedia application areas.

UNIT I MULTIMEDIA ELEMENTS **9**

Principles - Cognition, Learning, Interaction, Medium of Consumption; Elements - Text, Characteristics, standards, formats; Graphics - Representation, File formats; Image / Graphics - File formats, Standards; Digital Audio - Characteristics, Formats, Standards, Speech; Video - Characteristics, Formats; Animation - characteristics, Formats.

UNIT II MULTIMEDIA TOOLS AND AUTHORING **9**

Hardware - Display Devices, Wearables, Graphics cards, I/O devices; Software - Editing tools for Text, Image, Audio, Video and animation; Authoring tools - Authoring Multimedia presentations, Authoring Metaphors.

UNIT III MULTIMEDIA COMPRESSION **9**

Symmetric and Asymmetric methods - Lossy and Lossless Compression, Text compression, RLE, Huffman, Arithmetic, Dictionary based; Document Image compression standards - CCITT and Color Image Compression - JPEG; Audio Compression - PCM, ADPCM, MPEG, AAC, AC3, speech compression; Video Compression - MPEG-4, H.265, DVI.

UNIT IV MULTIMEDIA COMMUNICATION SYSTEMS **9**

Multimedia Communication Standards - Transport Protocols, streaming protocols, Internet Protocols Wireless multimedia communications; Synchronization and QOS - Security, Entertainment networks, Real- time distributed multimedia networks, Hypertext, Hypermedia.

UNIT V MULTIMEDIA APPLICATIONS **9**

Applications for WWW - Multimedia databases - Indexing and Retrieval, Visualization, Virtual, Augmented and Mixed Reality; Interactive E-learning - HCI and UX design, Games and Animation, Real-Time video conferencing.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- discuss about the components of multimedia elements.
- use Multimedia tools in multimedia applications.
- implement Compression algorithms for various multimedia applications.
- describe effective strategies to deliver Quality-of-Experience in networked Multimedia applications
- design and develop multimedia applications in various domains.

TEXT BOOKS

1. Ze-Nian Li, Mark S. Drew, Jiangchuan Liu, "Fundamentals of Multimedia", Second Edition, Springer Nature (Texts in Computer Science), 2014.
2. Prabhat K. Andleigh, Kiran Thakrar, "Multimedia Systems Design", Pearson Education India, Ist Edition, 2015.

REFERENCES

1. Fred Halsall, "Multimedia Communications: Applications, Networks, Protocols and Standards", Pearson Education, 2002.
2. Khalid Sayood, "Introduction to Data Compression", 4th Edition, Morgan Kauffman, 2012.
3. K.R. Rao, Zoran S. Bojkovic, Bojan M. Bakmaz, "Wireless Multimedia Communication systems: Design, Analysis and Implementation", CRC press, 2017.
4. V.S. Subrahmanian, "Principles of Multimedia Database Systems", Elsevier / Morgan Kauffmann, 2008.

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CO2	1	-	3	3	2	3	-	2	2	2	-	3	3	2
CO3	1	-	3	3	3	3	-	3	3	3	-	3	3	3
CO4	1	-	3	2	3	2	-	2	3	2	-	3	3	3
CO5	2	-	3	3	3	3	-	2	3	3	-	3	3	3

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CS20652 **INFORMATION RETRIEVAL** **3 0 0 3**

COURSE OBJECTIVES

To enable the students to

- acquire knowledge about information retrieval systems.
- write code for text construction and compression.
- learn to evaluate information retrieval systems and language models.
- understand the concepts of Text Classification and Text clustering.
- know about search engine and information extraction.

UNIT I INTRODUCTION TO INFORMATION RETRIEVAL **9**

Boolean retrieval model; The term vocabulary and postings lists; Dictionary and tolerant retrieval.

UNIT II INDEXING AND COMPRESSION **9**

Blocked sort - based indexing, Single pass in memory indexing, Distributed indexing, Dynamic indexing, Other types of indexes; Statistical properties of terms in information retrieval; Dictionary compression - Postings file compression.

UNIT III EVALUATION, PROBABILISTIC AND LANGUAGE MODELS **9**

Evaluation in information retrieval - XML retrieval, Probabilistic information retrieval, Language models for information retrieval.

UNIT IV TEXT CLASSIFICATION & TEXT CLUSTERING **9**

The text classification problem - Naive Bayes text classification, K- nearest neighbors; Support vector Machine; Feature Selection; Vector-space clustering - K-means algorithm, Hierarchical clustering.

UNIT V WEB SEARCH BASICS, CRAWLING, INDEXES, LINK ANALYSIS **9**

Web Characteristic - Search user experience, Index size and estimation, Near duplicates and shingling; Crawling; Distributing indexes; Connectivity servers - Web As a graph, Page Rank, Hubs and Authorities. IR applications - Information extraction, Question answering, Opinion summarization, Social Network.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- discuss about information retrieval systems.
- summarize the different types of Indexing and compression techniques.
- evaluate information retrieval systems and language models.
- describe about text classification and clustering.
- elaborate web search engine, crawling and information extraction.

TEXT BOOKS

1. Christopher D. Manning, Prabhakar Raghavan and Hinrich Schutze, "Introduction to Information Retrieval", Cambridge University Press. 2008.
2. ChengXiang Zhai, "Statistical Language Models for Information Retrieval", (Synthesis Lectures Series on Human Language Technologies), Morgan & Claypool Publishers, 2008.

REFERENCES

1. Stefan Buettcher, Charles L. A. Clarke, Gordon V. Cormack, "Information Retrieval: Implementing and Evaluating Search Engines", MIT Press, 2010.
2. Ricardo Baeza-Yates and Berthier Ribeiro-Neto, "Modern Information Retrieval: The Concepts and Technology behind Search", Second Edition, ACM Press Books, 2011.
3. Stefan Buettcher, Charles L. A. Clarke and Gordon, V. Cormack, "Information Retrieval: Implementing and Evaluating Search Engines", The MIT Press, 2010.
4. Ricardo Baeza-Yates and Berthier Ribeiro-Neto, " Modern Information Retrieval", Addison Wesley, 1999.

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CO4	1	-	3	2	3	2	-	2	3	2	-	3	3	3
CO5	2	-	3	3	3	3	-	1	2	2	-	3	3	3

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CS20653 **INFORMATION VISUALIZATION** **3 0 0 3**

COURSE OBJECTIVES

To enable the students to

- know the data types and information, analysis
- understand the concepts and significance of data visualization.
- learn the visualization idioms and map data attributes to graphical attributes.
- evaluate the effectiveness of visualization designs.
- comprehend the considerations in information dashboard design.

UNIT I INTRODUCTION **9**

Visualization Definition and Need - Data Abstraction, Data Semantics and Types, Data Types, Dataset, Types(DL); Attribute Types - Semantics, Task Abstraction, Analyze tasks abstractly, Actions, Targets, Analyzing and Deriving.

UNIT II ANALYSIS **9**

Four levels for Validation - Reasons to Validate, Four levels of Design, Angles of Attack; Threats to Validity - Validation Approaches, Validation Examples; Marks and Channels - Defining Marks and Channels, Using Marks and Channels, Channel Effectiveness; Relative versus Absolute Judgements - Rules of Thumb to be followed, No unjustified 3D, No unjustified 2D, Eyes beat memory; Resolution over Immersion - Overview, Zoom, Filter, Details on demand; Responsiveness is required - Get it Right
in Black and White.

UNIT III TABLES AND SPATIAL DATA **9**

Arrange by Keys and Values - Express; Quantitative Values - Separate, Order, and Align; Categorical Regions - Matrix Alignment; Two Keys - Volumetric Grid; Three Keys - Recursive Subdivision; Multiple Keys - Spatial Axis Orientation, Spatial Layout Density, Arrange Spatial data, Geometry, Scalar Fields; One Value - Vector Fields; Multiple Values - Tensor Fields; Many Values.

UNIT IV NETWORKS, TREES, MAP COLOR **9**

Connection; Link Marks - Matrix Views, Connection versus Matrix, Containment; Hierarchy Marks - Map Color and Other Channels, Color Theory, Color maps, Other Channels, Reduce items and attributes, Reasons to Reduce, Filter, Aggregate, Manipulate View; Reasons for Change - Change View over Time, Select Elements, Navigate; Changing Viewpoint - Reducing Attributes.

UNIT V INFORMATION DASHBOARD DESIGN **9**

Clarifying the Vision - Variations in Dashboard Uses and Data, Common Mistakes in Dashboard Design, Fundamental considerations in dashboard design; Power of Visual Perception - Key Goals in the Visual Design process, Dashboard Display Media. Comparing simple plot formats for polling data using R, Exploring and making visual comparisons for football dataset using R.

TOTAL PERIODS 45

COURSE OUTCOMES:

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

- describe the data abstraction and data visualization
- design and create data visualizations.
- apply data transformations such as aggregation and filtering for visualization.
- evaluate choice of colour and visual encoding suitable for visualization.
- use knowledge of perception and cognition to design information dashboards.

TEXT BOOKS

1. Tamara Munzner, "Visualization Analysis and Design", CRC Press, 2014.
2. Stephen Few, "Information Dashboard Design: Displaying Data for At-a-glance Monitoring", Analytics Press, Second Edition, 2013.

REFERENCES

1. Alexander Telea, "Data Visualization Principles and Practice", CRC Press, Second Edition, 2014.
2. Andy Kirk, "Data Visualization: A Successful Design Process", PACKT Publishing, 2012.
3. Karl Pover, "Leaning Qlik View Data Visualization", PACKT, 2013.
4. Stephen Few, "Show Me the Numbers: Designing Tables and Graphs to Enlighten", Analytics Press, Second Edition, June 2012.

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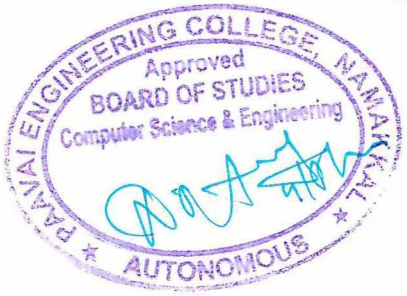
CO3	3	3	3	1	3	3	-	-	3	3	1	3	3	2
CO4	3	3	3	1	3	2	-	2	3	2	2	3	3	3
CO5	3	2	1	1	1	3	-	1	2	3	2	3	3	2



CS20654 KNOWLEDGE REPRESENTATION AND REASONING 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- know the fundamental aspects and the language of first order logic.
- learn about the Expressing Knowledge and Resolution.
- understand the reasoning and how to control.
- gain the knowledge of rules in production system.
- infer the basics of object-oriented representations.

UNIT I THE LANGUAGE OF FIRST-ORDER LOGIC 9

The Key Concepts- Knowledge, Representation, and Reasoning-The Role of Logic; The language of first First-Order Logic - The Syntax ,The Semantics, The Pragmatics , Explicit and Implicit Belief.

UNIT II EXPRESSING KNOWLEDGE AND RESOLUTION 9

Expressing Knowledge - Knowledge Engineering, Vocabulary, Basic Facts, Complex Facts, Terminological Facts, Entailments, Abstract Individuals, Other Sorts of Facts; Resolution - The Propositional Case, Handling Variables and Quantifiers, Dealing with Computational Intractability.

UNIT III REASONING WITH HORN CLAUSES AND PROCEDURAL CONTROL OF REASONING 9

Reasoning With Horn Clauses - Horn Clauses, SLD Resolution, Computing SLD Derivations; Procedural Control Of Reasoning - Facts and Rules, Rule Formation and Search Strategy, Algorithm Design, Specifying Goal Order, Committing to Proof Methods, Controlling Backtracking Negation as Failure, Dynamic Databases.

UNIT IV RULES IN PRODUCTION SYSTEMS 9

Rules In Production Systems - Production Systems, Basic Operation, Working Memory, Production Rules, A First Example, A Second Example, Conflict Resolution, Making Production Systems More Efficient, Applications and Advantages, Significant Production Rule Systems.

UNIT V OBJECT-ORIENTED REPRESENTATION AND STRUCTURED DESCRIPTIONS 9

Object-Oriented Representation - Objects and Frames, A Basic Frame Formalism, An Example: Using Frames to Plan a Trip; Structured descriptions - Descriptions, A Description Language, Meaning and Entailment, Computing Entailments, Taxonomies and Classification.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- analyze the problems with reasoning.
- revoke the expressing knowledge and resolution.
- analyze the procedural control of reasoning.
- solve the rules in production system problems.
- design the object-oriented representation.

TEXT BOOKS

1. Ronald J. Brachman & Hector J. Levesque, "Knowledge representation and Reasoning", Elsevier 2004.
2. Deepak Khemani. "A First Course in Artificial Intelligence", McGraw Hill Education (India), 2013.

REFERENCES

1. Schank, Roger C., Robert P. Abelson, "Scripts, Plans, Goals, and Understanding: An Inquiry into Human Knowledge Structures", Hillsdale, NJ: Lawrence Erlbaum, 1977.
2. R. C. Schank and C. K. Riesbeck, "Inside Computer Understanding: Five Programs Plus Miniatures ", Lawrence Erlbaum, 1981.
3. Murray Shanahan, "A Circumscriptive Calculus of Events. Artificial Intelligence 77(2)", 1995.
4. John F. Sowa: Conceptual Structures, " Information Processing in Mind and Machine", Addison-Wesley Publishing Company, Reading Massachusetts, 1984.

CO-PO MAPPING:

Mapping of Course Outcomes with Programme Outcome
(1,2,3 indicates the strength of correlation) 3 - Strong, 2 - Medium, 1 - Weak

CO	Programme Outcomes (POs)												Programme Specific Outcomes (PSOs)	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	1	1	1	1	-	-	-	-	-	2	1	2
CO2	2	2	1	1	1	1	-	-	1	2	1	2	1	2
CO3	2	2	3	1	1	1	-	-	1	2	1	2	1	3
CO4	2	2	3	3	1	1	-	-	1	2	1	2	1	3
CO5	2	2	3	3	1	1	-	-	1	2	1	2	1	3

PAVAI ENGINEERING COLLEGE, NAMAKKAL
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BOARD OF STUDIES
Computer Science & Engineering

OPEN ELECTIVE COURSES (OE-II)

CS20903 **WEB DESIGNING** **3 0 0 3**

COURSE OBJECTIVES

To enable the students to

- acquire knowledge on developing webpage.
- learn fundamental web design concepts.
- create the webpage using HTML tags.
- design webpage using various elements in HTML such as list, table, and frames.
- apply different style sheets concepts to enrich the webpage.

PRE - REQUISITE: Nil

UNIT I WEB DESIGN INTRODUCTION **9**

Environment and Tools -The Internet and the World Wide Web, Ways to Access the Internet and the web, Types of websites; Web Design Tools; Web Design Roles; Web publishing fundamentals, Advantages of web publishing; Basic web design principles; Web publishing issues.

UNIT II WEB DESIGN CONCEPTS **9**

Website Development planning process - Define the site's purpose; Identify the target audience; Determine the site's general content, Select the site's structure, Design the look and feel of the site; Specify the site's navigation system; Typography and images.

UNIT III INTRODUCTION TO HTML **9**

What is HTML - HTML Documents-Basic structure of an HTML document, Creating an HTML document; Mark up Tags, Heading, Paragraphs, Line Breaks; HTML Tags.

UNIT IV ELEMENTS OF HTML **9**

Introduction to elements of HTML - Working with Text; Working with Lists, Tables and Frames; Working with Hyperlinks, Images and Multimedia; Working with Forms and controls.

UNIT V CASCADING STYLE SHEETS **9**

Concept of CSS - Creating Style Sheet, CSS Properties, CSS Styling (Background, Text Format, Controlling Fonts); Working with block elements and objects; Working with Lists and Tables; CSS Id and Class; Box Model (Introduction, Border properties, Padding-Properties, Margin properties); CSS Advanced (Grouping, Dimension, Display, Positioning, Floating, Align, Pseudo class, Navigation Bar, Image Sprites, Attribute sector); CSS Color; Creating page Layout and Site Designs.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- define the basics and principle of Web design
- understand the web design concepts
- visualize the basic concept of HTML.
- recognize the elements of HTML.
- introduce basics concept of CSS.

TEXT BOOKS

1. Gary B.Shelly, H.Albert Napier, Ollie N. Rivers, "Web Design: Introductory Concepts and Techniques", Course Technology, Cengage Learning, Third Edition, 2009.
2. Thomas A.Powell, "The Complete reference: HTML & CSS", McGraw Hill, Jan 2010.

REFERENCES

1. Laura Lemay, Rafe Colburn, Jennifer Kyrnin, "Mastering HTML, CSS and Java Script Web Publishing", BPB Publications, June 2016.
2. Jennifer Niederst Robbins, " A Beginner's Guide to HTML, CSS, JavaScript, and Web Graphics", John Wiley & Sons Publications Fifth Edition , 2018
3. Jon Duckett, "HTML & CSS Design and Build Websites", John Wiley & Sons, Nov 2011.
4. Jennifer Niederst Robbins," Learning Web Design", John Wiley & Sons publications, Fifth Edition, 2018.

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CO1	3	3	1	1	1	-	-	-	1	-	-	-	2	1
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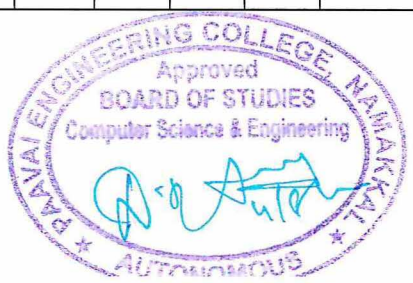
CO3	3	3	3	1	3	-	-	-	1	-	1	2	2	1
CO4	3	3	3	1	3	-	-	-	1	-	2	3	2	1
CO5	3	3	3	1	3	-	-	-	1	-	2	3	2	1



CS20904 **ANDROID APPLICATION DEVELOPMENT** 3 0 0 3

COURSE OBJECTIVES

To enable students to

- understand android SDK.
- gain a basic understanding of Android application development.
- know about Android Studio developmenttool.
- acquire knowledge of Android application design.
- learn to test and publish Android applications.

UNIT I INTRODUCTION 9

Introduction to Android - The Android Platform, Android SDK, Eclipse Installation, Android Installation, Building you First Android application, Understanding Anatomy of Android Application.

UNIT II ANDROID APPLICATION 9

Application Using the Android Manifest File; Master the Android Development Tools; Designing Compatible application.

UNIT III ANDROID USER INTERFACE DESIGN ESSENTIALS 9

Android User Interface Design Essentials - User Interface Screen elements, Designing User Interfaces with Layouts - Working with Dialogs.

UNIT IV ANDROID APPLICATION DESIGN ESSENTIALS 9

Working with Fragments; Using Android Preferences; working with files and directories; Managing Application resources - Working with different types of resources.

UNIT V TESTING AND PUBLISHING ANDROID APPLICATION 9

Testing Android application - Testing mobile application, Testing Environment; Leveraging Android Tools and Application; Publishing Android application - Distribution model, application for publication, Publishing on the Android Market.

TOTAL PERIODS 45

COURSE OUTCOMES

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

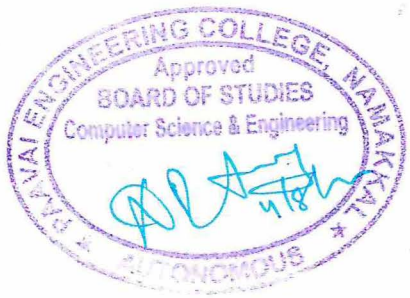
- identify various concepts of android development.
- outline design a simple android application.
- utilize rapid prototyping techniques to design user interface.
- program mobile applications for the Android operating system that use basic and advanced phone features.
- deploy applications to the Android marketplace for distribution.

TEXT BOOKS

1. T.Lauren Darcey and Shane Conder, "Android Wireless Application Development", Pearson Education, 3rd ed. (2012).
2. Reto Meier , "Professional Android 4 Application Development", Wiley India, (Wrox) , 2012.

REFERENCES

1. Reto Meier, "Professional Android 2 Application Development", Wiley India Pvt Ltd.
2. Mark L Murphy, "Beginning Android", Wiley India Pvt Ltd.
3. Wallace Jackson, "Android Apps for Absolute Beginners", Press, 2012.
4. Bill Phillips, Chris Stewart, "Android Programming: The Big Nerd Ranch Guide", Addison Wesley Professional, 2015.

CO-PO MAPPING:

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CO1	-	1	1	-	1	-	-	2	1	-	-	2	-	1
CO2	1	2	1	2	-	2	-	1	1	2	1	2	-	2
CO3	1	-	2	1	-	1	2	3	2	1	3	2	2	1
CO4	2	-	3	1	-	2	-	1	1	-	-	3	2	-
CO5	-	1	1	-	-	1	-	-	1	-	-	3	-	-