KARNATAK UNIVERSITY, DHARWAD
ACADEMIC (S&T) SECTION

ಕರ್ನಾಟಕ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಧಾರವಾಡ
ವಿದ್ಯಾಮಂಡಳ (ಎಸ್&ಟಿ) ವಿಭಾಗ

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NAAC Accredited
'A' Grade 2014

website: kud.ac.in

No. KU/Aca(S&T)/JS/MGJ(Gen)/2024-25/436 Date: 11 NOV 2024

ಅಧಿಸೂಚನೆ

ವಿಷಯ: ರಾಷ್ಟ್ರೀಯ ಶಿಕ್ಷಣ ನೀತಿಯನುಸಾರ 2024–25ನೇ ಶೈಕ್ಷಣಿಕ ಸಾಲಿನಿಂದ ಎಲ್ಲ ಸ್ನಾತಕೋತ್ತರ ಪದವಿಗಳಿಗೆ / ಸ್ನಾತಕೋತ್ತರ ಡಿಪ್ಲೋಮಾಗಳಿಗೆ ಪಠ್ಯಕ್ರಮವನ್ನು ಪ್ರಕಟಣೆ ಕುರಿತು.

ಉಲ್ಲೇಖ: 1. ವಿದ್ಯಾವಿಷಯಕ ಪರಿಷತ್ ಸಭೆಯ ನಿರ್ಣಯ ಸಂಖ್ಯೆ: 2 ರಿಂದ 9, ದಿ: 08.11.2024.

2. ಮಾನ್ಯ ಕುಲಪತಿಗಳ ಅನುಮೋದನೆ ದಿನಾಂಕ: 11.11.2024.

ರಾಷ್ಟ್ರೀಯ ಶಿಕ್ಷಣ ನೀತಿಯನುಸಾರ 2024–25ನೇ ಶೈಕ್ಷಣಿಕ ಸಾಲಿನಿಂದ ಅನ್ವಯವಾಗುವಂತೆ, ಕರ್ನಾಟಕ ವಿಶ್ವವಿದ್ಯಾಲಯದ ಎಲ್ಲ ಸ್ನಾತಕೋತ್ತರ ಪದವಿಗಳಾದ M.A./ M.Sc / M.Com / MBA / M.Ed 1 ರಿಂದ 4ನೇ ಸೆಮೆಸ್ಟರ್‌ಗಳಿಗೆ ಮತ್ತು 1 & 2ನೇ ಸೆಮೆಸ್ಟರ್‌ಗಳ ಸ್ನಾತಕೋತ್ತರ ಡಿಪ್ಲೋಮಾಗಳಿಗೆ ವಿದ್ಯಾವಿಷಯಕ ಪರಿಷತ್ ಸಭೆಯ ಅನುಮೋದನೆಯೊಂದಿಗೆ ಈ ಕೆಳಗಿನಂತೆ ಪಠ್ಯಕ್ರಮಗಳನ್ನು ಅಳವಡಿಸಿಕೊಳ್ಳಲಾಗಿದೆ. ಕಾರಣ, ಸಂಬಂಧಪಟ್ಟ ಎಲ್ಲ ಸ್ನಾತಕೋತ್ತರ ವಿಭಾಗಗಳ ಅಧ್ಯಕ್ಷರು / ಸಂಯೋಜಕರು / ಆಡಳಿತಾಧಿಕಾರಿಗಳು / ಮಹಾವಿದ್ಯಾಲಯಗಳ ಪ್ರಾಚಾರ್ಯರುಗಳು / ಶಿಕ್ಷಕರು ಸದರಿ ಪಠ್ಯಕ್ರಮಗಳನ್ನು ಅನುಸರಿಸುವುದು ಮತ್ತು ಸದರಿ ಪಠ್ಯಕ್ರಮವನ್ನು ಕ.ವಿ.ವಿ. ಅಂತರ್ಜಾಲ www.kud.ac.in ದಲ್ಲಿ ಭತ್ತರಿಸಲಾಗಿದನ್ನು ಸಂಬಂಧಪಟ್ಟ ವಿದ್ಯಾರ್ಥಿಗಳಿಗೆ ಸೂಚಿಸುವುದು.

Arts Faculty

Sl.No	Programmes	Sl.No	Programmes
1	Kannada	8	MVA in Applied Art
2	English	9	French
3	Folklore	10	Urdu
4	Linguistics	11	Persian
5	Hindi	12	Sanskrit
6	Marathi	13	MPA Music
7	MVA in Painting		

Faculty of Science & Technology

Sl.No	Programmes	Sl.No	Programmes
1	Geography	10	M.Sc (CS)
2	Chemistry	11	MCA
3	Statistics	12	Marine Biology
4	Applied Geology	13	Criminology & Forensic Science
5	Biochemistry	14	Mathematics
6	Biotechnology	15	Psychology
7	Microbiology	16	Applied Genetics
8	Zoology	17	Physics
9	Botany	18	Anthropology

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Faculty of Social Science

Sl.No	Programmes	Sl.No	Programmes
1	Political Science	8	Journalism m & Mass Commn.
2	Public Administration	9	M.Lib. Information Science
3	History & Archaeology	10	Philosophy
4	A.I.History & Epigraphy	11	Yoga Studies
5	Economics	12	MTTM
6	Sociology	13	Women's Studies
7	MSW		

Management Faculty

Sl.No	Programmes	Sl.No	Programmes
1	MBA	2	MBA (Evening)

Faculty of Commerce

Sl.No	Programmes	Sl.No	Programmes
1	M.Com	2	M.Com (CS)

Faculty of Education

Sl.No	Programmes	Sl.No	Programmes
1	M.Ed	2	M.P.Ed

OEC subject for PG

Sl.No	Programmes	Sl.No	Programmes
1	Russian	5	Veman Peetha
2	Kanaka Studies	6	Ambedkar Studies
3	Jainology	7	Chatrapati Shahu Maharaj Studies
4	Babu Jagajivan Ram	8	Vivekanand Studies

PG Diploma

Sl.No	Programmes	Sl.No	Programmes
1	PG Diploma in Chatrapati Shahu Maharaj Studies	2	P.G. Diploma in Women's Studies
3	P.G. Diploma in Entrepreneurial Finance		

ಕುಲಸಚಿವರು.

ಅಡಕ: ಮೇಲಿನಂತೆ

ಗೆ,

1. ಕ.ವಿ.ವಿ. ಸ್ನಾತಕೋತ್ತರ ಅಧ್ಯಕ್ಷರುಗಳಿಗೆ / ಸಂಯೋಜಕರುಗಳಿಗೆ / ಆಡಳಿತಾಧಿಕಾರಿಗಳಿಗೆ / ಮಹಾವಿದ್ಯಾಲಯಗಳ ಪ್ರಾಚಾರ್ಯರುಗಳಿಗೆ
2. ಎಲ್ಲ ನಿಖಾಯದ ಡೀನರು, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.

ಪ್ರತಿ:

1. ಕುಲಪತಿಗಳ ಆಪ್ತ ಕಾರ್ಯದರ್ಶಿಗಳು, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.
2. ಕುಲಸಚಿವರ ಆಪ್ತ ಕಾರ್ಯದರ್ಶಿಗಳು, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.
3. ಕುಲಸಚಿವರು (ಮೌಲ್ಯಮಾಪನ) ಆಪ್ತ ಕಾರ್ಯದರ್ಶಿಗಳು, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.
4. ಅಧೀಕ್ಷಕರು, ಪ್ರಶ್ನೆ ಪತ್ರಿಕೆ / ಗೌಪ್ಯ / ಜಿ.ಎ.ಡಿ. / ವಿದ್ಯಾಂಡಳ (ಪಿ.ಜಿ.ಪಿಎಚ್.ಡಿ) ವಿಭಾಗ/ ಸಿಸ್ಟಮ್ ಅನಾಲೆಸಿಸ್ಟ್ / ಸಂಬಂಧಿಸಿದ ಪದವಿಗಳ ವಿಭಾಗಗಳು, ಪರೀಕ್ಷಾ ವಿಭಾಗ, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.
5. ನಿರ್ದೇಶಕರು, ಕಾಲೇಜು ಅಭಿವೃದ್ಧಿ / ವಿದ್ಯಾರ್ಥಿ ಕಲ್ಯಾಣ ವಿಭಾಗ, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.
6. ನಿರ್ದೇಶಕರು, ಐ.ಟಿ. ವಿಭಾಗ, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ ಇವರಿಗೆ ಕ.ವಿ.ವಿ. ಅಂತರ್ಜಾಲದಲ್ಲಿ ಪ್ರಕಟಿಸುವುದು.

KARNATAK UNIVERSITY, DHARWAD

P.G. Studies in

MASTER OF COMPUTER SCIENCE

(MCA)

(I-IV Semester)

Curriculum Structure
With Effect From
2024-25 onwards

PSO No.	Program Specific Outcomes (PSOs) Upon completion of this programme the student will be able to
PSO1	**Academic Competence:** (i) Understand various concepts of Computing, Statistics, Mathematics and Electronics appropriately to the discipline. (ii) Recommend computing solutions to solve the problems in different domains
PSO2	**Personal and Professional Competence:** (i) Apply the fundamental knowledge for professional software development as well as to acquire new skills. (ii) Develop strong problem solving, analyzing and decision-making abilities. Identify the information and apply their disciplinary knowledge and professional skills to design components , system or processes to meet required specification
PSO3	**Research Competence:** (i) Apply programming languages, tools and techniques to conduct research and demonstrate appropriate emerging skills to seek solutions to problems in various interdisciplinary fields. (ii) Integrate Computer Science, Electronics, Mathematical and Statistical knowledge to explore different domains' data for experimental and research purpose
PSO4	**Entrepreneurial and Social Competence:** (i) Use the knowledge and skills necessary to support their career in software development, web development, databases and entrepreneurship in recent trends like data analytics, artificial intelligence, Image processing, Networking, Embedded systems etc. (ii) Develop software based solutions for industry as well as research and development and develop skills required for social interaction.

GENERAL INSTRUCTIONS

1. One credit is equal to 1 hour theory teaching per week.
2. One credit is equal to 2 hour practical teaching per week.
3. One credit is equal to 15 hours theory syllabus per semester (1 Unit is equal to 15 Hours)
4. One credit is equal to 30 hours practical syllabus per semester (1 credit practical is equal to 2 hours per week)

A. ***Workload for theory subjects***

1. There shall be 16 hrs/week workload for Assistant Professor
2. There shall be 14 hrs/week workload for Associate Professor/ Professor/Senior Professor.
3. There shall be 2hrs/week workload relaxation for Guiding Ph.D. students

B. ***Workload for practical subjects***

1. There shall be 20 hrs/week workload for Assistant Professor
2. There shall be 18 hrs/week workload for Associate Professor/ Professor/Senior Professor.
3. There shall be 2hrs/week workload relaxation for Guiding Ph.D. students

C. ***Workload for practical batches***

1. A batch of 10-12 students shall have 1 teacher

D. ***Workload for Project***

1. Students for projects shall be preferably guided by permanent faculty for atleast10 students by sharing equally among the permanent faculty. If remained excess shall be allotted to other teacher's onroll on temporary basis.
2. If there are no permanent faculty, the students shall be distributed among the temporary teachers onroll.
3. There shall be maximum of 4 hrs/week workload for guiding the students for project work irrespective of number of students.

E. ***Allotment of Specialization***

While allotting specialization in 3^{rd} and 4^{th} semester, minimum of 10 students shall have to select the specialization.

F. ***Marks and Conduct of Examination***

1. Generally, 20% weightage for Formative assessment and 80% weightage for Summative assessment
2. Upto 2 credits equal to 50 marks (10 marks Formative assessment and 40 marks summative assessment)
3. 3-4 credits equal to 100 marks(20 marks Formative assessment and 80 marks summative assessment)
4. 5-6 credits equal to 150 marks(30 marks Formative assessment and 120 marks summative assessment)

5. Example for 100 marks out of which 20 marks for Formative assessment i.e., Formative Assessment shall be in two stages : 10 marks for 8th week and 10 marks for 14thweek of every semester.
6. 75% attendance is mandatory for every course(paper). No marks are reserved for attendance. If the candidates fails to fullfils 75% attendance in any one of the course(paper) in the given semester, such candidate is not eligible to appear for examination in all the papers and candidate has to get the readmission for such semester.

7. Passing criteria: Candidate has to score minimum 40% in summative examination and fulfil 40% of the maximum marks including Formative assessment marks. For example : for 80 marks summative examination, candidate has to score minimum of 32 marks(40%) and should score cumulatively 40 marks including formative assessment.
8. Candidate has to score 40% as above in all the courses to pass the semester end examination.
9. Marks obtained from the OEC shall not be considered for award of CASH PRIZE/RANK/GOLD MEDAL.

G. ***Project/Internship assessment***

1. Formative Assessment : Project/Internship assessment carrying 20 marks out of 100 marks
   Interaction with the project supervisor and submission of progress reports = 10 + 10 marks
2. Summative Assessment : Project/Internship assessment carrying 80 marks out of 100 marks
   a. Project Report : 35
   b. Presentation : 20
   c. Viva-voce 25

GENERAL PATTERN OF THEORY QUESTION PAPER
(80 marks for semester end Examination with 4hrs duration)

Answer any FIVE full questions out of EIGHT questions.
Each full question has a, b & c sub questions.
Question paper has two parts. Pat-A (questions from unit I & II) & Part-B (questions from unit III & IV)
Students should answer two questions from each part. 5^{th} question is from either part.

GENERAL PATTERN OF PRACTICAL QUESTION PAPER
(80 marks for semester end Examination with 3hrs duration)

Exercise / Experiments	60 Marks
Journal	05 Marks
Viva-Voce	15 Marks

Formative Assessment for Theory	
Assessment Occasion	**Marks**
Internal Assessment Test 1	10
Internal Assessment Test 1	10
Total	**20 Marks**
Formative Assessment as per guidelines	

MCA Computer Science
Academic Year 2024-25

Sem.	Type of Course	Theory/ Practical	Course Code	Subject Title	Credits	No. of hour per week Theory / Practical	Duration of Exam	Internal Assessment Marks Theory / Practical	Semester end Exam Marks	Total Marks
I	DSC-1	Theory	A1MCA001T	Python Programming	4	4	3 hrs.	20	80	100
	DSC -2	Theory	A1MCA002T	Digital Logic and Computer Design	4	4	3 hrs.	20	80	100
	DSC -3	Theory	A1MCA003T	Theory of Computation	4	4	3 hrs.	20	80	100
	DSC -4	Theory	A1MCA004T	Advanced DBMS	4	4	3 hrs.	20	80	100
	DSC -5	Theory	A1MCA005T	Operating System	4	4	3 hrs.	20	80	100
	DSC -6	Practical	A1MCA006P	Python Programming Lab	2	4	3 hrs.	10	40	50
	DSC -7	Practical	A1MCA007P	Advanced DBMS Lab	2	4	3 hrs.	10	40	50
II	DSC -8	Theory	A2MCA008T	Design and Analysis of Algorithms	4	4	3 hrs.	20	80	100
	DSC -9	Theory	A2MCA009T	Web Technologies	4	4	3 hrs.	20	80	100
	DSC -10	Theory	A2MCA010T	Linear Algebra	4	4	3 hrs.	20	80	100
	DSC -11	Theory	A2MCA011T	Data Mining	4	4	3 hrs.	20	80	100
	DSC -12	Practical	A2MCA012P	Data Mining Lab	2	4	3 hrs.	10	40	50
	DSC -13	Practical	A2MCA013P	Web Technologies Lab	2	4	3 hrs.	10	40	50
	OEC-1	Theory	A2MCA2001T	Computer Networks	4	4	3 hrs.	20	80	100

Sem.	Type of Course	Theory/ Practical	Course Code	Subject Title	Credits	No. of hour per week Theory / Practical	Duration of Exam	Internal Assessment Marks Theory / Practical	Semester end Exam Marks	Total Marks
III	DSC -14	Theory	A3MCA014T	Machine Learning	4	4	3 hrs.	20	80	100
	DSC -15	Theory	A3MCA015T	Software Engineering	4	4	3 hrs.	20	80	100
	DSC -16	Theory	A3MCA016T	Computer Graphics	4	4	3 hrs.	20	80	100
	DSC -17	Theory	A3MCA017T	Electives-I	4	4	3 hrs.	20	80	100
	DSC -18	Practical	A3MCA018P	Machine Learning Lab	2	4	3 hrs.	10	40	50
	DSC -19	Practical	A3MCA019P	Computer Graphics Lab	2	4	3 hrs.	10	40	50
	OEC-2	Theory	A3MCA2002T	Digital Image processing	4	4	3 hrs.	20	80	100
IV	DSC -20	Theory	A4MCA020T	Operation Research	4	4	3 hrs.	20	80	100
	DSC -21	Theory	A4MCA021T	Network Security	4	4	3 hrs.	20	80	100
	DSC -22	Theory	A4MCA022T	Electives-II	4	4	3 hrs.	20	80	100
	DSC-23	Theory	A4MCA023T	Artificial Intelligence	4	4	3 hrs.	20	80	100
	DSC-24	Practical	A4MCA024P	Artificial Intelligence Lab	2	4	3 hrs.	10	40	50
	DSC -25	Project	A4MCA025P	Project	6	12		50	100	150

Elective-1:
1. DSC -17A: Block Chain technology
2. DSC -17B: Mobile communications
3. DSC -17C: Cloud Computing

Elective-2:
1. DSC -22A: Deep Learning
2. DSC -22B: IOT
3. DSC -22C: Soft Computing

I Semester

DSC-1: Python Programming

Type of Course	Theory/ Practical	Credits	No. of hour per week Theory / Practical	Duration of Exam	Internal Assessment Marks Theory / Practical	Semester end Exam Marks	Total Marks
DSC-1	Theory	4	4	3 hrs.	20	80	100

Course Outcomes: **Total hours:60**

1. To learn and understand Python programming basics and paradigm.
2. To develop Python programs with conditionals and loops.
3. To define Python functions and to use Python data structure- lists, tuples, dictionaries,
4. Understand the file handling and Exception handling
5. To understand the different issues involved in the design and implementation of object oriented Programming.

Unit	Content	60hrs
I	Introduction to Python - The IDLE Python Development Environment - The Python Standard Library - Literals - Numeric Literals - String Literals - Control Characters - String Formatting - Implicit and Explicit Line Joining Variables and Identifiers - Variable Assignment and Keyboard Input- Identifier-Keywords and Other Predefined Identifiers in Python – Operators - Various Operators - Relational Operators-Membership Operators – Boolean Operators - Expression and Data Types -Operator Precedence and Boolean Expressions - Operator Associativity - MixedType Expression.	15
II	Control Structure -Selection Control- If Statement - Indentation in Python - Multi-Way Selection - Iterative Control - While Statement - Input Error Checking - Infinite loops - Definite vs. Indefinite Loops. List Structures - Common List Operations - List Traversal - Lists (Sequences) in Python- Python List Type. Tuples- Sequences- Nested Lists Iterating Over Lists (Sequences) in Python - For Loops - The Built-in range Function - Iterating Over List Elements vs. List Index Values-While Loops and Lists (Sequences) - Dictionaries and sets.	15
III	Defining Functions - Calling Value-Returning Functions - Calling Non-Value-Returning Functions - Parameter Passing - Keyword Arguments in Python - Default Arguments in Python - Variable Scope - Recursive functions. String Processing - String Traversal - String-Applicable Sequence Operations -String Methods. Exception Handling -The Propagation of Raised Exceptions - Catching and Handling Exceptions -Exception Handling and User Input.	15
IV	File Handling: Text, Binary and CSV file Handling: Access Modes, Writing Data to a File, Reading Data from a File, Additional File Methods. CLASSES AND OBJECTS: Introduction, Defining Classes, Creating Objects, Data Abstraction and Hiding through Classes, Class method and self argument, Class Constructor (init() Method), Data Members, Calling a Class Method from another Class Method, Class Methods and Static Methods,	15

	Inheritance, Types of Inheritance, Abstract Classes and Interfaces, Operator Overloading, Overriding Methods.	

Reference Books:

1. Charles Dierbach, Introduction to Computer Science using Python , Wiley First Edition.
2. Balaguruswamy E., Introduction to Computing and Problem Solving using Python.
3. R. Nageswara Rao, "Core Python Programming", dreamtech.
4. Allen B. Downey, ``Think Python: How to Think Like a Computer Scientist.
5. Python Programming: A Modern Approach, Vamsi Kurama, Pearson.

Formative Assessment for Theory	
Assessment Occasion	**Marks**
Internal Assessment Test 1	10
Internal Assessment Test 1	10
Total	**20 Marks**
Formative Assessment as per guidelines	

DSC-2 Digital Logic and Computer Design

Type of Course	Theory/ Practical	Credits	No. of hour per week Theory / Practical	Duration of Exam	Internal Assessment Marks Theory / Practical	Semester end Exam Marks	Total Marks
DSC-2	Theory	4	4	3 hrs.	20	80	100

Course Outcomes: **Total hours:60**

1. Understand number systems and Boolean algebra for digital circuit design.
2. Design and simplify combinational and sequential logic circuits using HDL.
3. Explore processor architecture, focusing on arithmetic logic units and control logic.
4. Study microcomputer organization, including memory and input/output interfacing.
5. Gain practical skills in 8085 assembly language programming for system operations.

Unit	Content	60hrs
I	**Number Systems:** binary, octal hexadecimal, number base conversion, addition, subtraction of binary numbers, one's and two's complements, positive and negative numbers, character codes ASCH, EBCDIC. **Boolean algebra and Logic gates:** Axiomatic definition of Boolean algebra, Basic theorems and properties, Boolean functions, canonical and standard forms, logic functions using gates and design of combinational circuits. **Simplification of Boolean functions:** Karnaugh maps, product of sums, sum of products, simplification, NAND and NOR implementation, don't care condition.	15

II	**Combinational and Sequential logic:** Adders, sub-tractors, code, converters, decoder, encoders and multiplexer. **Synchronous Sequential logic:** Sequential Circuit, latches, Flip-flop, Analysis of Clocked Sequential circuits, HDL for Sequential Circuits, State Reduction &Assignment,Design procedure. **Register &Counters**: Shift Register, Ripple Counters, Synchronous Counter, Asynchronous Counter, Ring Counters, Module-n Counters, HDL for Register & Counters.	15
III	**Processor Logic Design:** Processor organization, arithmetic logic unit, design of arithmetic and logic circuits, design of arithmetic logic unit, status registers, design of shifter, processor unit, design of accumulator. **Control Logic Design:** Processor Organization, Hardware control micro program control, control of processor unit, PLA control, micro program sequencer, computer design. **Micro – computer System Design:** Microcomputer organization, microprocessor organization, instructions and addressing modes, subroutines and interrupts, memory organization, input-output interface, programmed input-output, input – output processor, input – output device characteristics, direct memory access (DMA).	15
IV	**Memory Organization:** Serial access, random access memories (RAM), read only memories (ROM), virtual memory, cache memory. **Introduction to 8085Assembly Language Programming**: The 8085 Programming model, Instruction classification, Instruction format, How to write, Assemble and Execute a simple program. **Digital Integrated logic Circuits:** Introduction, special characteristics, RTL, DTL, TTL,ECL, MOS & C-MOS Logic circuits,. Switch level modeling with HDL.	15

References:

1. Digital Logic and Computer Design, Morris Mano, PHI
2. Digital Computer Fundamentals, Bartee, T.C., MC Graw Hill
3. Computer Architecture and Organization, Tanenbaum A.S., Mc Graw Hill
4. Computer Architecture and Organization, hayes, J.P., Mc Graw Hill
5. Introduction to Microprocessors, Gaonkar, Tata Mc Graw Hill
6. Digital Computer Electronics Malvino& Brown Shird Education, TMH.

Formative Assessment for Theory	
Assessment Occasion	**Marks**
Internal Assessment Test 1	10
Internal Assessment Test 1	10
Total	**20 Marks**
Formative Assessment as per guidelines	

DSC-3 Theory of Computation

Type of Course	Theory/ Practical	Credits	No. of hour per week Theory / Practical	Duration of Exam	Internal Assessment Marks Theory / Practical	Semester end Exam Marks	Total Marks
DSC-3	Theory	4	4	3 hrs.	20	80	100

Course Outcomes: **Total hours:60**

1. To give an overview of the theoretical foundations of computer science from the perspective of formal languages
2. To illustrate finite state machines to solve problems in computing
3. To explain the hierarchy of problems arising in the computer sciences
4. To familiarize Regular grammars, context frees grammar.

Unit	Content	60hrs
I	Introduction To Finite Automata: Introduction to Finite Automata, the central concepts of Automata theory, deterministic finite automata, non-deterministic finite automata, an application. Finite automata with Epsilon-transitions. Regular Expressions and Languages, Properties of Regular Languages: Regular expression, Finite Automata and Regular Expressions, Applications of Regular Expressions, Proving languages not to be regular,	15
II	Closure properties of Regular languages, Decision properties of Regular languages. Equivalence and minimization of automata. Context-Free Grammars And Languages: Context-free grammars. Parse trees, Applications, Ambiguity in grammars and languages.	15
III	Pushdown Automata: Definition of the Pushdown automata, The languages of a PDA, Equivalence of PDA's and CFG's, Deterministic Pushdown Automata. Properties Of Context-Free Languages: Normal forms for CFGs, The pumping lemma for CFGs, Closure properties of CFLs.	15
IV	Introduction To Turing Machines: Problems that computers cannot solve. The Turing Machine, Programming techniques for Turing Machines, Extensions to the basic Turing Machine, Restricted Turing Machines, Turing Machine and Computers. Undecidability: A Language that is not recursively enumerable, An Undecidable problem that is RE, Post's Correspondence problem. Other un decidable problems.	15

References:

1. J.P. Hopcroft, Rajeev Motwani, J.D. Ullman, Introduction to automata Theory, Languages and Computation, 3rd edition, Pearson Education, 2008.
2. Introduction to Formal Languages and Automata, Peter Linz, 6th edition, Narosa Publ., 2013

3. Languages & Machine An Introduction to Computer Science, Thomds A Sud Kamp, Addison Wesley.
4. Elements of theory of Computation, H.R. Lewis, Shistor H, Papadimitroce, Prentice Hall, New Delhi 1999
5. Introduction to Language and Theory of Computation, John Mastin TMH New Delhi, 1998.

Formative Assessment for Theory	
Assessment Occasion	**Marks**
Internal Assessment Test 1	10
Internal Assessment Test 1	10
Total	**20 Marks**
Formative Assessment as per guidelines	

DSC-4 Advance Database Management Systems

Type of Course	**Theory/ Practical**	**Credits**	**No. of hour per week Theory / Practical**	**Duration of Exam**	**Internal Assessment Marks Theory / Practical**	**Semester end Exam Marks**	**Total Marks**
DSC-4	Theory	4	4	3 hrs.	20	80	100

Course Outcomes: **Total hours:60**

1. To learn data models, conceptualize and depict a database system using ER diagram
2. To understand the internal storage structures in a physical DB design
3. To know the fundamental concepts of transaction processing techniques
4. To understand the concept of Database Design in Normalization techniques
5. To know the manipulation of SQL Queries

Unit	**Content**	**60hrs**
I	**Data Modelling Using the Entity-Relationship (ER):** Using High-Level Conceptual Data Models for Database Design. A sample Database Application. Entity Types, Entity Sets, Attributes and Keys, Relationship Types, Relationship Sets, Roles, and Structural Constraints. Weak Entity Types Refining the ER Design for the COMPANY Database, ER Diagrams, Naming Conventions. **The Relational Data Model and Relational Database Constraints:** Relational Model Concepts, Relational Model Constraints and Relational Database Schemas. Update Operations, Transactions and Dealing with Constraint Violations.	15
II	**Basic SQL:** SQL Data Definition and Data Types, Specifying Constraints in SQL, Basic Retrieval Queries in SQL, INSERT, DELETE, and UPDATE Statements in SQL,Additional Features of SQL **More SQL: Complex Queries, Triggers, Views, and Schema Modification:** More Complex SQL Retrieval Queries, Specifying Constraints as Assertions and Actions as Triggers, Views (Virtual Tables) in	15

	SQL. **Basics of Functional Dependencies and Normalization for Relational Databases** Informal Design Guidelines for Relation Schemas, Functional Dependencies Normal Forms Based on Primary Keys General Definitions of Second and Third Normal FormsBoyce-Codd Normal Form Multivalued Dependency and Fourth Normal Form Join Dependencies and Fifth Normal Form	
III	**Introduction to Transaction Processing Concepts:** Introduction to Transaction Processing, Transaction and System Concepts Desirable Properties of Transaction,Characterizing Schedules Based on Recoverability Characterizing Schedules Based on Serializability **Concurrency Control Techniques** Two – Phase Locking Techniques for Concurrency Control Concurrency Control Based on Timestamp Ordering Multiversion Concurrency Control Techniques Validation (Optimistic) Techniques and Snapshot Isolation Concurrency Control Granularity of Data Items and Multiple Granularity Locking Using Locks for Concurrency Control in Indexes	15
IV	**Enhanced Data Models: Introduction to Active, Temporal, Spatial, Multimedia and Deductive Databases:** Active Databases Concepts and Triggers, Temporal Database ConceptsSpatial Database Concepts, **Overview of Data Warehousing and OLAP:** Introduction, Definitions, and Terminology2Characteristics of Data Warehouses,Data Modelling for Data Warehouses, Building a Data Warehouse Typical Functionality of a Data WarehouseData Warehouse versus Views	15

Text Books

1. 1. Ramez Elmasri, Shamkant B. Navathe, “Fundamentals of Database Systems”, Fourth Edition, Pearson/Addision Wesley, 2007.
2. J. Date, A. Kannan, S. Swamynathan, “An Introduction to Database Systems”, Eighth Edition, Pearson Education, 2006.

Reference Books

1. Silberschatz, Henry F. Korth, S. Sudharshan, “Database System Concepts”, Fifth Edition, Tata McGraw Hill, 2006
2. Raghu Ramakrishnan, “Database Management Systems”, Third Edition, McGraw Hill, 2003.
3. S. K. Singh, “Database Systems Concepts, Design and Applications”, First Edition, Pearson Education, 2006.

Formative Assessment for Theory	
Assessment Occasion	**Marks**
Internal Assessment Test 1	10
Internal Assessment Test 1	10
Total	**20 Marks**
Formative Assessment as per guidelines	

DSC-5 Operating System Concepts

Type of Course	Theory/ Practical	Credits	No. of hour per week Theory / Practical	Duration of Exam	Internal Assessment Marks Theory / Practical	Semester end Exam Marks	Total Marks
DSC-5	Theory	4	4	3 hrs.	20	80	100

Course Outcomes: **Total hours:60**

1. Describe the basics of the operating systems, mechanisms of OS to handle processes, threads, and their communication.
2. Analyze the memory management and its allocation policies.
3. Illustrate different conditions for deadlock and their possible solutions.
4. Discuss the storage management policies with respect to different storage management technologies
5. Evaluate the concept of the operating system with respect to UNIX, Linux, Time, and mobile OS.

Unit	Content	60hrs
I	**Introduction:** Operating system concepts, types of operating system – Batch, interactive, time sharing, real time and distributed operating systems. Operating system services, system calls, system components, system programs. **Process Management:** Processes-process scheduling, operation on processors, co- operating process threads, interprocess communication, concept of critical section problem and solution, semaphores and implementation.	15
II	**CPU Scheduling:** Scheduling criteria and scheduling algorithms, multiple processor scheduling. **Deadlock:** Deadlock problem, characterization, prevention, avoidance, detection, recovery, combined approach to deadlock handling.	15
III	**Memory Management:** Logical and physical address, swapping overlays, contiguous allocation, paging segmentation, segmentation with paging, virtual memory-demand paging page replacement algorithms. **Disk and Drum Scheduling:** Physical characteristics FCFS, Shortest seek time first, SCAN scheduling, selection of disk scheduling algorithm, sector queuing.	15
IV	**File System:** Files, access method, directory structure, protection and file system implementation, allocation methods. **Protection:** Goals, mechanism and policies, doman of protection, access matrix and its implementation, dynamic protection structure, revocation, security.	15

REFERENCES:

1. Operating systems Concepts, Peterson, J. and Sliberschatz, McGraw Hill.2006
2. Operating system, Madnick, S.E. Donovan J.J., McGraw Hill.
3. Operating system Principles, Brinch Hansen P., PHI.
4. A logical Design of Operating systems, Shaw A.., PHI
5. Operating systems, Milan Milenkovic, McGraw Hill.
6. Fundamentals of Operating system, including case studies, Sridhar. R., MS- DOS, UNIX & OS/2, Dynaram Publications.
7. Windows 3.1 A Complete Tutorial, Galgotia Publication Pvt., Ltd., Subhash Mehta.
8. Systems Programming and Operating system, McGraw Hill.

Formative Assessment for Theory	
Assessment Occasion	**Marks**
Internal Assessment Test 1	10
Internal Assessment Test 1	10
Total	**20 Marks**
Formative Assessment as per guidelines	

II Semester

DSC-8 : Design and Analysis of Algorithms

Type of Course	Theory/ Practical	Credits	No. of hour per week Theory / Practical	Duration of Exam	Internal Assessment Marks Theory / Practical	Semester end Exam Marks	Total Marks
DSC-8	Theory	4	4	3 hrs.	20	80	100

Course Outcomes: **Total hours:60**

1. Analyze the asymptotic performance of algorithms.
2. Derive and solve recurrences describing the performance of divide-and-conquer algorithms.
3. Find optimal solution by applying various methods.
4. Apply pattern matching algorithms to find particular pattern.
5. Differentiate polynomial and non-polynomial problems.

Unit	Content	60hrs
I	**Analysis of Algorithm:** Fundamentals of Algorithmic Problem Solving, Analysis Framework, Asymptotic Notations and Basic efficiency classes, Mathematical analysis of Recursive and Non-recursive algorithms.The efficient algorithm, Average, Best and worst case analysis, , Sorting Algorithms and analysis: Bubble sort, Selection sort, Insertion sort.	15
II	Divide and Conquer Algorithm: Introduction, Recurrence and different methods to solve recurrence, Multiplying large Integers Problem, Problem Solving using divide and conquer algorithm - Binary Search, Max-Min problem, Sorting (Merge Sort, Quick Sort), Matrix Multiplication, Exponential.	15
III	Greedy Algorithm : General Characteristics of greedy algorithms, Problem solving using Greedy Algorithm - Activity selection problem, Elements of Greedy Strategy, Minimum Spanning trees (Kruskal's algorithm, Prim's algorithm), Graphs: Shortest paths, The Knapsack Problem, Job Scheduling Problem, Huffman code.	15
IV	Introduction to NP-Completeness:The class P and NP, Polynomial reduction, NP- Completeness Problem, NP-Hard Problems. Travelling Salesman problem, Hamiltonian problem, Approximation algorithms.	15

Reference Books

1. Introduction to Algorithms by Thomas H. Cormen, Charles E. Leiserson, Ronald L.PHI publications.
2. Fundamental of Algorithms by Gills Brassard, Paul Bratley,PHI publications.
3. Introduction to Design and Analysis of Algorithms by Anany Levitin, Pearson publications.
4. Design and Analysis of Algorithms by Dave and Dave, Pearson publications.

Formative Assessment for Theory	
Assessment Occasion	**Marks**
Internal Assessment Test 1	10
Internal Assessment Test 1	10
Total	**20 Marks**
Formative Assessment as per guidelines	

DSC-9 Web-Technologies

Type of Course	Theory/ Practical	Credits	No. of hour per week Theory / Practical	Duration of Exam	Internal Assessment Marks Theory / Practical	Semester end Exam Marks	Total Marks
DSC-9	Theory	4	4	3 hrs.	20	80	100

Course Outcomes: **Total hours:60**

1. To understand different Internet Technologies
2. To learn java-specific web services architecture
3. To Develop web applications using frameworks
4. To facilitate students to connect to databases using JDBC
5. To familiarize various concepts of application development using JSP

Unit	Content	60hrs
I	**Introduction:** Web Basics: Internet, Internet, WWW, Static and Dynamic Web Page; Web Clients; Web Servers, Client Server Architecture: Single Tier, Two-Tier, Multi-Tier, HTTP: HTTP Request and Response; URL, Client Side Scripting, Server Side Scripting, Web 1.0, Web 2.0 **Hyper Text Mark-up Language:** Introduction to HTML; Elements of HTML Document; HTML Elements and HTML Attributes, Headings, Paragraph, Division, Comments in HTML, Formatting: b,i, small, sup, sub; Spacing: Pre, Br; Formatting Text Phrases: span, strong, tt , Image element; Anchors; Lists: Ordered and Unordered and Definition;, Tables(table, tr, td colspan, rowspan, thead, tbody, tfoot); Frames (iframe), Forms: Form Elements, ID attributes, Class Attributes of HTML Elements, Meta Tag, Audio (src, controls, auto ply, preload, loop), Video (src, controls, auto play, poster, loop), Canvas, Main, Section, Article, Header, Footer, Aside Nav, Figure Tags, HTML Events: Window Events, Form Element Events, Keyboard Events, Mouse Event	15
II	**Cascading Style Sheets:** Introduction; Cascading Style Sheets (CSS); CSS Syntax, Inserting CSS: Inline, Internal, External, CSS ID and Class Selectors, Colors; Backgrounds; Borders; Text; Font; List; Table CSS Box Model; Normal Flow Box Layout: Basic Box Layout, Display Property, Padding, Margin; Positioning: Relative, Float, Absolute, CSS3 Borders, Box Shadows, Text Effects and Shadow, Basic of Responsive Web Designs; Media Queries (Media Types, Viewport)Introduction to Bootstrap (Basic concepts and installation)	15
III	**Client Side Scripting with JavaScript:** Structure of Java Script Program, Variables and Data Types; Statements: Expression, Keyword, Block; Operators, Flow Controls, Looping, Functions; Popup Boxes: Alert , Confirm, Prompt ,Objects and properties; Constructors **AJAX and XML:** Basic of AJAX, Introduction to XML and its Application, Syntax Rules for creating XML document, XML Elements; XML Attributes; XML Tree, XML Namespace, XML schema languages: Document Type	15

	Definition (DTD), XML schema Definition (XSD); XSD Simple Types, XSD attributes' XSD complex types, XML Style Sheets (XSLT), Xquery	
IV	**Server Side Scripting with JavaScript** **Introduction to Servlets:** Common Gateway Interface (CGI), Lifecycle of a Servlets, deploying a Servlets, The Servlets API, Reading Servlets parameters, Reading initialization parameters, Handling Http Request & Responses, Using Cookies and sessions, connecting to a database using JDBC .**Introduction to JSP:** The anatomy of a JSP Page, JSP Page, JSP Processing, Declarations, Directives, Expressions, Code Snippets, implicit objects, Using Beans in JSP Pages, Using Cookies and session tracking, Connecting to database in JSP. Introduction to angular JS, Firebase, Docker, NodeJS,React,Django-UI and UX **Web Security:** Introduction, Web Security, The Principles of Web Security, Availability, Authentication, Authorization, Confidentiality, Auditing, Itegrity, Common Client – Side Attacks, Eavesdropping Attacks, Man-in-the Middle Attacks, Cross Side Request Forgery, UI Redressing, Session Hijacking, Cross-Site Scripting, Security Threats, SQL Injection, Form Validation and Security, CAPTCHA Role and Implementation.	15

TEXT BOOKS:

1. Web Technologies, Uttam K Roy, Oxford University Press
2. The Complete Reference PHP – Steven Holzner, Tata McGraw-Hill

REFERENCE BOOKS:

1. Web Programming, building internet applications, Chris Bates 2nd edition, Wiley Dremtech
2. Java Server Pages – Hans Bergsten, SPD O'Reilly 3 . Java Script, D.Flanagan, O'Reilly, SPD.
3. Beginning Web Programming-Jon Duckett WROX. 5
4.Programming world wide web, R.W. Sebesta. Fourth Edition, Pearson. 6. Internet and World Wide Web – How to program, Dietel and Nieto, Pearson

Formative Assessment for Theory	
Assessment Occasion	**Marks**
Internal Assessment Test 1	10
Internal Assessment Test 1	10
Total	**20 Marks**
Formative Assessment as per guidelines	

DSC-10 LINEAR ALGEBRA

Type of Course	Theory/ Practical	Credits	No. of hour per week Theory / Practical	Duration of Exam	Internal Assessment Marks Theory / Practical	Semester end Exam Marks	Total Marks
DSC-10	Theory	4	4	3 hrs.	20	80	100

Course Outcomes: **Total hours:60**

1. employ techniques to classify and solve linear systems of equations
2. illustrate the use of matrices and determinants
3. utilize vector spaces and linear transformations
4. explore the concept of orthogonality in vector spaces
5. compute eigenvalues and eigenvectors of matrices
6. Understanding the applications of SVD

Unit	Content	60hrs
I	**Introduction to Vector:** Vector and linear combination, Length and Dot products, Matrices. **Solving Linear Equations:** Vectors and linear equations, the idea of elimination, Elimination using matrices, Rules for matrix, Inverse Matrices, Elimination=Factorization: A=LU, Transposes and permutations.	15
II	**Vector Spaces and Subspaces:** Spaces of Vectors, The Null space of A, The Complete Solution to Ax=b, Independence, Basis and Dimension, Dimension of the Four Subspaces. **Orthogonality:** Orthogonality of the four subspaces, Projections, Least squares approximations, Orthogonal bases and Gram-Schmidt.	15
III	**Determinants:** The properties of Determinants, Permutations and Cofactors, Cramer's Rule, Inverses, and Volumes. **Eigen values and Eigenvectors:** Introduction to Eigenvalues, Diagonalizing a Matrix, Systems	15
IV	**Single Value Decomposition (SVD):** Principal Component Analysis(PCA), Bases and Matrices in the SVD, Principal Component Analysis by SVD.	15

TEXT BOOKS:

1. S Lang, Introduction to Linear Algebra.
2. Gilbert Strang, Introduction to Linear Algebra

REFERENCES:

1) Introduction to Linear Algebra by Gilbert Strang (5^{th} edition), Wellesley – Cambridge press, 2016
2) Linear Algebra by Kenneth Hoffman and Ray Kunze (2^{nd} edition), Prentice-Hall, 1971

3) Introduction to Linear Algebra by Thomas A Whitelaw, (2nd edition), Champman & Hall/ CRC, 2018
4) Introduction to Linear Algebra with applications by Jim De Franza & Daniel Gagliardi, Waveland Press.

Formative Assessment for Theory	
Assessment Occasion	**Marks**
Internal Assessment Test 1	10
Internal Assessment Test 1	10
Total	**20 Marks**
Formative Assessment as per guidelines	

DSC -11 **Data Mining**

Type of Course	Theory/ Practical	Credits	No. of hour per week Theory / Practical	Duration of Exam	Internal Assessment Marks Theory / Practical	Semester end Exam Marks	Total Marks
DSC-11	Theory	4	4	3 hrs.	20	80	100

Course Outcomes **Total:60hrs**

1. Ability to perform the preprocessing of data and apply mining techniques on it.
2. Ability to identify the association rules, classification and clusters in large data sets.
3. Ability to solve real world problems in business and scientific information using data mining.
4. Ability to classify web pages, extracting knowledge from the web.

Unit	Content	60hrs
I	**Introduction to Data Mining**: Introduction, what is Data Mining, Definition, KDD, Challenges, Data Mining Tasks, Data Pre-processing, Data Cleaning, Missing data, Dimensionality Reduction, Feature Subset Selection, Discretization and Binarization, Data Transformation; Measures of Similarity and Dissimilarity- Basics.	15
II	**Association Rules**: Problem Definition, Frequent Item Set Generation, The APRIORI Principle, Support and Confidence Measures, Association Rule Generation; APRIOIRI Algorithm, The Partition Algorithms, FP-Growth Algorithms, Compact Representation of Frequent Item Set- Maximal Frequent Item Set, Closed Frequent Item Set.	15
III	**Classification**: Problem Definition, General Approaches to solving a classification problem, Evaluation of Classifiers, Classification techniques, Decision Trees-Decision tree Construction, Methods for Expressing attribute test conditions, Measures for Selecting the Best Split, Algorithm for Decision	15

	tree Induction; Naive-Bayes Classifier, Bayesian Belief Networks; K-Nearest neighbor classificationAlgorithm and Characteristics.	
IV	**Clustering:** Problem Definition, Clustering Overview, Evaluation of Clustering Algorithms, Partitioning Clustering-K-Means Algorithm, K-Means Additional issues, PAM Algorithm; Hierarchical ClusteringAgglomerative Methods and divisive methods, Basic Agglomerative Hierarchical Clustering Algorithm, Specific techniques, Key Issues in Hierarchical Clustering, Strengths and Weakness; Outlier Detection. **Web and Text Mining**: Introduction, web mining, web content mining, web structure mining, we usage mining, Text mining –unstructured text, episode rule discovery for texts, hierarchy of categories, text clustering	15

REFERENCES:

1. Data Mining- Concepts and Techniques- Jiawei Han, Micheline Kamber, Morgan Kaufmann Publishers, Elsevier, Edition, 2006.
2. Introduction to Data Mining, Pang-Ning Tan, Vipin Kumar, Michael Steinbanch, Pearson Education.
3. Data mining Techniques and Applications, Hongbo Du Cengage India Publishing.
4. Data Mining Techniques, Arun K Pujari, 3rd Edition, Universities Press.

Formative Assessment for Theory	
Assessment Occasion	**Marks**
Internal Assessment Test 1	10
Internal Assessment Test 1	10
Total	**20 Marks**
Formative Assessment as per guidelines	

OEC-I
OEC-1 COMPUTER NETWORKS

Type of Course	**Theory/ Practical**	**Credits**	**No. of hour per week Theory / Practical**	**Duration of Exam**	**Internal Assessment Marks Theory / Practical**	**Semester end Exam Marks**	**Total Marks**
OEC-1	Theory	4	4	3 hrs.	20	80	100

Course Outcomes **Total:60hrs**

1. Explain basic concepts, OSI reference model, services and role of each layer of OSI model and TCP/IP, networks devices and transmission media, Analog and digital data transmission.
2. Describe the functions of Network Layer i.e. Logical addressing, subnetting & Routing Mechanism. channel allocation, framing, error and flow control techniques.

3. Explain the different Transport Layer functions i.e. Port addressing, Connection Management, Error control and Flow control mechanism.
4. Explain the functions of session and presentation layer. Explain the different protocols used at application layer i.e. HTTP, SNMP, SMTP, FTP, TELNET

Unit	Content	60hrs
I	Foundation- Building a Network, Applications, Requirements, Architecture, Software, Performance. Direct Links- Connecting to a Network, Technology Landscape, Encoding, Framing, Error Detection, Reliable Transmission, Multi-Access Networks. Internetworking: Switching Basics, Switched Ethernet, Spanning Tree Algorithm, Broadcast and Multicast, Virtual LANs (VLANs). What Is an Internetwork? Service Model, Global Addresses, Datagram Forwarding in IP, Subnetting and Classless Addressing, Address Translation (ARP), Host Configuration (DHCP), Error Reporting (ICMP), Virtual Networks and Tunnels, Routing- Network as a Graph, Distance-Vector (RIP), Link State (OSPF), Metrics.	15
II	Global Internet- Routing Areas, Inter-domain Routing (BGP), IP Version 6-Historical Perspective, Addresses and Routing, Packet Format, Advanced Capabilities. Multicast- Multicast Addresses, Multicast Routing (DVMRP, PIM, MSDP), Multiprotocol Label Switching-Destination-Based Forwarding, Explicit Routing, Virtual Private Networks and Tunnels.	15
III	Simple Demultiplexer (UDP), Reliable Byte Stream (TCP)- End-to-End Issues, Segment Format, Connection Establishment and Termination, Sliding Window Revisited, Triggering Transmission, Adaptive Retransmission. Remote Procedure Call- RPC Fundamentals Transport for Real-Time (RTP)-Requirements, RTP Design, Control Protocol Congestion Control- TCP Congestion Control	15
IV	Applications-Traditional Applications- Electronic Mail (SMTP, MIME, IMAP), World Wide Web (HTTP), Web Services, Multimedia Applications-Session Control and Call Control (SDP, SIP, H.323), Resource Allocation for Multimedia Applications	15

Reference books:

1. Larry Peterson, “Computer Networks- A system approach”, 5th edition, Elsevier, 2012
2. Kurose and Rose, “Computer Networking- A top down approach”, 6th edition, Pearson, 2013
3. Andrew Tanenbaum, “Computer Networks”, Prentice Hall, 6th edition, 2022
4. Behrouz Forouzan, “Data Communications and Networking”, 4th edition, McGraw Hill, 2017

Formative Assessment for Theory	
Assessment Occasion	**Marks**
Internal Assessment Test 1	10
Internal Assessment Test 1	10
Total	**20 Marks**
Formative Assessment as per guidelines	

Semester – III
DSC-14 Machine Learning

Type of Course	Theory/ Practical	Credits	No. of hour per week Theory / Practical	Duration of Exam	Internal Assessment Marks Theory / Practical	Semester end Exam Marks	Total Marks
DSC-14	Theory	4	4	3 hrs.	20	80	100

Course Outcomes: **Total hours:60**

1. Understanding popular ML algorithms with their associated mathematical foundations for appreciating these algorithms.
2. Capability to implement basic algorithms using basic machine learning libraries mostly in python.
3. Make aware of the role of data in the future of computing and also in solving real-world problems using machine learning algorithms.
4. Help connect real-world problems to appropriate ML algorithm(s) for solving them. Enable formulating real-world problems as machine learning tasks.
5. Appreciate the mathematical background behind popular ML algorithms.
6. Ensure awareness about importance of core CS principles such as algorithmic thinking and systems design in ML.

Unit	Content	60hrs
I	The applications of Association Rule Mining: Market Basket, Recommendation Engines, etc. A mathematical model for association analysis; Large item sets; Association Rules. Apriori: Construct large item sets with mini sup by iterations; Interestingness of discovered association rules; **Supervised Learning** **Regression:** Regression in supervised learning is the technique of understanding the relationship between a dependent and an independent variable. It is used to predict continuous outcomes in predictive modelling. Introduction to Regression: Definition, types, and use cases. Linear Regression: Theory, cost function, gradient descent, and assumptions. Polynomial Regression: Adding polynomial terms, degree selection, and overfitting. Lasso and Ridge Regression: Regularization techniques for controlling model complexity. Evaluation metrics for regression models: Mean Square Error (MSE), R-Squared, and Mean Absolute Error (MAE) **Classification** Another application of supervised learning is classification, where the machine learning model tries to predict the right label for a given input data. This section introduces you to Classification, its types and use cases, along with knowledge of logistic regression, decision trees and random forests. You will also learn about the evaluation metrics for classification models Introduction to Classification. Logistic Regression: Theory, logistic Function, binary and multiclass classification. Decision Trees: Construction, splitting criteria, pruning, and visualization. Random Forests: Ensemble learning, bagging, and feature importance. Evaluation metrics for classification models: Accuracy, Precision, Recall, F1-score, and ROC curves.	20

II	**SVM, KNN & Naive Bayes** SVM, KNN and Naive Bayes are the three popular supervised learning algorithms. You will learn them all from this segment in detail. Support Vector Machine (SVM): Study SVM theory, different kernel functions (linear, polynomial, radial basis function), and the margin concept. Implement SVM classification and regression and evaluate the models. K-Nearest Neighbors (KNN): Understand the KNN algorithm, distance metrics, and the concept of K in KNN. Implement KNN classification and regression and evaluate the models. Navie Bayes: Learn about the Naive Bayes algorithm, conditional probability, and Bayes' theorem. Implement Navie Bayes classification and evaluate the model's performance **Ensemble Methods and Boosting** AdaBoost: Boosting technique, weak learners, and iterative weight adjustment. Gradient Boosting (XGBoost): Gradient boosting algorithm, Regularization, and hyperparameter tuning. Evaluation and fine-tuning of ensemble model: Cross-validation, grid search, and model selection. Handling imbalanced datasets: Techniques for dealing with class imbalance, such as oversampling and under sampling.	20
III	**Unsupervised Learning** **Clustering** Introduction to Clustering: Definition, types, and use cases. K-means Clustering: Algorithm steps, initialization methods, and elbow method for determining the number of clusters. DBSCAN (Density-Based Spatial Clustering of Applications with Noise): Core points, density reachability, and epsilon-neighborhoods. Evaluation of clustering algorithms: Silhouette score, cohesion, and separation metrics **Dimensionality Reduction** Introduction to Dimensionality Reduction: Curse of dimensionality, feature extraction, and feature selection. Principal Component analysis (PCA): Eigenvectors, eigenvalues, variance explained, and dimensionality reduction.	15
IV	**Reinforcement Learning** Introduction to Reinforcement Learning: Agent, environment, state, action, and reward. Markov Decision Processes (MDP): Markov property, transition probabilities, and value functions. Q-Learning algorithm: Exploration vs. exploitation, Q-table, and learning rate.	15

Text Books

1. Marc Peter Deisenroth, A. Aldo Faisal, Cheng soon Ong, **Mathematics for Machine Learning,** Cambridge University Press (23 April 2020)
2. Tom M. Mitchell – **Machine Learning** – McGraw Hill Education, *International Edition*
3. Aurelien Geron **Hands – On Machine Learning with Scikit – Learn, Keras, and Tensorflow,** O'Reilly Media, Inc. 2nd Edition

Reference Books

4. Ian Goodfellow, Yoshoua Bengio, and Aaron Courville **Deep learning** MIT Press Ltd, *Illustrated edition*

5. Christopher M. Bishop **Pattern Recognition and Machine Learning –** Springer, *2nd edition*
6. Trevor Hastie, Robert Tibshirani, and Jerome Friedman – **The Elements of Statistical Learning :**
Data Mining, Inference and Prediction – Springer, *2nd edition*

Formative Assessment for Theory	
Assessment Occasion	**Marks**
Internal Assessment Test 1	10
Internal Assessment Test 1	10
Total	**20 Marks**
Formative Assessment as per guidelines	

DSC-15 SOFTWARE ENGINEERING

Type of Course	**Theory/ Practical**	**Credits**	**No. of hour per week Theory / Practical**	**Duration of Exam**	**Internal Assessment Marks Theory / Practical**	**Semester end Exam Marks**	**Total Marks**
DSC-15	Theory	4	4	3 hrs.	20	80	100

Course Outcomes: **Total hours:60**

1. Explain the fundamental concepts of Software Engineering Lifecycle models, stages of software development.
2.Describe software engineering layered technology and Process frame work.
3.Analysing the various design and development solutions with specification.
4.Describe the software testing process, debugging, validation.

Unit	**Content**	**60hrs**
I	**The Software Process and Process models:** A Generic Process Model, defining a Framework Activity, Identifying a Task Set, Process Patterns. Prescriptive Process Models, The Waterfall Model, Incremental Process Models, Evolutionary Process Models, Concurrent Models, Specialized Process Models, The Unified Process, Personal and Team Process Models. Agility and the Cost of Change, Agile Process, Agility Principles, The Politics of Agile Development, Extreme Programming, Other Agile Process Models.	15
II	**Requirements Modeling** Requirements Engineering, Establishing the Groundwork, Eliciting Requirements, Elements of the Analysis Model, Requirements for Self-Adaptive Systems, Negotiating Requirements, Requirements Monitoring, Validating Requirements. Requirements Analysis, Scenario-Based Modeling, Creating a Behavioral Model, Identifying Events with the Use Case, State Representations.	15

III	**Design Concepts** The Design Process, Design Concepts, Design Model, Software Architecture, Architectural Styles, Architectural Design, Designing Class-Based Components, Component-Level Design for WebApps, User Interface Design, The Golden Rules, User Interface Analysis and Design, Interface Analysis, Interface Design Steps, WebApp Design Quality, Design Goals, A Design Pyramid for WebApps, WebApp Interface Design, Aesthetic Design, Content Design, Architecture Design, Navigation Design.	15
IV	**Software Testing Concepts** A Strategic Approach to Software Testing, Test Strategies for Conventional Software, Test Strategies for Object-Oriented Software, Test Strategies for WebApps, Validation Testing, System Testing, The Art of Debugging, Software Testing Fundamentals, White-Box Testing, Basis Path Testing, Black-Box Testing, Model-Based Testing, Object-Oriented Testing Strategies, Object-Oriented Testing Methods, Testing Methods Applicable at the Class Level, Interclass Test-Case Design, Testing Concepts for WebApps, User Interface Testing, Content Testing	15

References:

1. Software Engineering- A practitioner's approach, 8th Edition, Roger S. Pressman and Bruce R. Maxim, McGraw Hill, 2014.
2. Software Engineering, 9th edition, Ian Sommerville, Addison-Wesley, Pearson Education, Inc., 2017
3. Fundamentals of Software Engineering, 5th Edition, Rajib Mall, PHI, 2018
4. The Software Engineer's Guidebook, Gergely Orosz, The Pragmatic Engineer, 2023
5. Fundamentals of Software Engineering, Amiya Kumar Rath and Hitesh Mohapatra, Bpb Publications, 2020

Formative Assessment for Theory	
Assessment Occasion	**Marks**
Internal Assessment Test 1	10
Internal Assessment Test 1	10
Total	**20 Marks**
Formative Assessment as per guidelines	

DSC-16Computer Graphics

Type of Course	Theory/ Practical	Credits	No. of hour per week Theory / Practical	Duration of Exam	Internal Assessment Marks Theory / Practical	Semester end Exam Marks	Total Marks
DSC-16	Theory	4	4	3 hrs.	20	80	100

Course Outcomes: **Total hours:60**

1. Explain the functions and characteristics of raster and vector devices.
2. Implement algorithms to draw basic geometric shapes accurately.
3. Apply clipping and filling techniques for lines and polygons.
4. Develop representations for 3D objects and perform transformations.
5. Implement algorithms for visible surface determination and rendering techniques.
6. Create a simple animation algorithm to demonstrate graphical movement.

Unit	Content	60hrs
I	**Basics of computer graphics:** Introduction, What is computer Graphics? Area of Computer Graphics, Design and Drawing, Animation Multimedia applications, Simulation, How are pictures actually stored and displayed, Difficulties for displaying pictures**.** Computer graphics and its applications in various fields. Hardware system for graphics working of different input devices, visual display devices and hard copy device. Introduction to different coordinate systems. Raster Scan display: Concepts of resolution, aspect ratio refresh rate and frame buffer. Random scan displays: Concepts of display file and display file interpreted comparison between raster scan and random scan. Implementation of graphics in 'C' language and study of various graphics functions.	15
II	**Line drawing methods:** Point Plotting Techniques, Qualities of good line drawing algorithms, The Digital Differential Analyzer **(**DDA) algorithm and Bresenham's algorithm for different scope conditions, midpoint method for line generation. Two- dimensional transformation: Mathematical treatment of basic transformation such as translation scaling and rotation. Development of composite transformation matrices using homogeneous coordinates. General fixed point scaling and pivot point rotation. **Graphical input techniques:** Graphical Input Techniques, Positioning Techniques, Positional Constraints, and Rubber band Techniques. **Clipping:** Study of Cohen Sutherland line clipping procedure and Sutherl and hodgmen polygon clipping procedure. **Windows and view ports:** Derivation of generalized window to view porttrans formation matrix. Introduction to interrupt driven programming in 'C' and interacting with the mouse.	15
III	**Three-dimensional Computer Graphics:** Introduction to left and right hand coordinate systems, Need for 3-Dimensional Imaging, Techniques for 3-Dimesional displaying, basic 3D transformation. Hidden line removal. Projection**:** Study of ortho graphic and oblique parallel transformation equations for them. Three Dimensional transformation, Translations,	15

	Scaling, Rotation, Viewing Transformation, The Perspective, Algorithms, Three Dimensional Clipping, Perspective view of Cube.	
IV	**Graphic software standards:** GKS and PHIGS. Study of various attributes of output primitives such as line attributes, area fill attributes and character attributes. **Graphics Software Study**: DirectX and OpenGL. **Segments:** Concepts and advantages. Segment table various operations on segments. Data structures for the display file arrays on segment, linked list and paging schemes M **Miscellaneous topics**: Brief introduction to Bezier curves and their application, fractal morphing and animation.	15

REFERENCE:

1. New manand Sproull: Principles of Interactive Computer Graphics McGraw Hill,1996.
2. S.Harrington: Computer graphics McGrawHill, 1997.
3. YeshwantKanetkar: Graphicsunder"C"BPB, 1995.
4. YeshwantKanetkar: CPearlsBPB, 1996.
5. Hearn Donald PaulingBaker.M:Computer Graphics EEEPHI,1998

Formative Assessment for Theory	
Assessment Occasion	**Marks**
Internal Assessment Test 1	10
Internal Assessment Test 1	10
Total	**20 Marks**
Formative Assessment as per guidelines	

Digital Image processing (OEC-2)

Type of Course	Theory/ Practical	Credits	No. of hour per week Theory / Practical	Duration of Exam	Internal Assessment Marks Theory / Practical	Semester end Exam Marks	Total Marks
OEC-2	Theory	4	4	3 hrs.	20	80	100

Course Outcomes: **Total hours:60**

1. Identify the fundamental elements of an image and Describe the need of digital image processing.
2. Understand different types of image transformation techniques and their properties.
3. Use various noise models and Calculate the values for restoration and degradation models.
4. Analyze and Evaluate various image compression techniques.
5. Integrate and Demonstrate various Image Transformation and Segmentation Techniques

Unit	Content	60hrs
I	**Introduction :** Fundamental Steps in Digital Image Processing, Components of an Image Processing System, Sampling and Quantization, Representing Digital Images (Data structure), Some Basic Relationships Between Pixels-	15

	Neighbors and Connectivity of pixels in image, Applications of Image Processing: Medical imaging, Robot vision, Character recognition, Remote Sensing.	
II	**Image Enhancement In The Spatial Domain:** Some Basic Gray Level Transformations, Histogram Processing, Enhancement Using Arithmetic/Logic Operations, Basics of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters, Combining Spatial Enhancement Methods. **Image Enhancement In Frequency Domain:** Introduction, Fourier Transform, Discrete Fourier Transform (DFT), properties of DFT, Discrete Cosine Transform (DCT), Image filtering in frequency domain.	15
III	**Image Restoration:** Model of the Image Degradation/Restoration Process, Noise Models- Spatial and Frequency Properties of Noise, Important Noise Probability Density Functions, Periodic Noise, Restoration in the Presence of Noise- Mean Filters, Order-Statistics Filters, Linear, Position-Invariant Degradations, Estimating the Degradation Function- Estimation by Image Observation, Estimation by Experimentation, Estimation by Modeling Inverse Filter, Minimum Mean Square Error (Wiener) Filter, Geometric Mean Filter.	15
IV	**Morphological Image Processing:** Basic Concepts from Set Theory, Logic Operations Involving Binary Images, Dilation and Erosion, Opening and Closing, Hit or Miss Transformation, Morphological Algorithms- Boundary Extraction, Region Filling, Extraction of Connected Components, Convex Hull, Thinning, Thickening, Skeletons, Pruning, Extensions to Gray Scale Images- Dilation, Erosion, Opening and Closing. **Image Segmentation:** Detection of Discontinuities- Point Detection, Line Detection, Edge Detection, Edge Linking and Boundary Detection. Thresholding: Foundation, Basic Global Thresholding, Basic Adaptive Threshold, Region-Based Segmentation- Basic Formulation, Region Growing, Region Splitting and Merging.	15

REFERENCES:

1. Fundamentals of Digital Image Processing, Anil K. Jain, Pearson, IIIrd, 2004.
2. Digital Image Processing, Rafel C. Gonzalez & Richard E. Woods, PHI, 10th, 2005.
3. Digital Image Processing using MATLAB, Rafel, Richard & Steven, Pearson, IInd, 2007.
4. Digital Image Processing, JayaramanS,VeerakumarT,Esakkirajan S, TMH, Ist, 2009.

Formative Assessment for Theory	
Assessment Occasion	**Marks**
Internal Assessment Test 1	10
Internal Assessment Test 1	10
Total	**20 Marks**
Formative Assessment as per guidelines	

Semester IV
DSC-20 Operation Research

Type of Course	Theory/ Practical	Credits	No. of hour per week Theory / Practical	Duration of Exam	Internal Assessment Marks Theory / Practical	Semester end Exam Marks	Total Marks
DSC-20	Theory	4	4	3 hrs.	20	80	100

Course Outcomes: **Total hours:60**

1. Solve linear programming problems using appropriate techniques and optimization solvers, interpret the results obtained.
2. Determine optimal strategy for Minimization of Cost of shipping of products from source to Destination/ Maximization of profits of shipping products using various methods, Finding initial basic feasible and optimal solution of the Transportation problems
3. Optimize the allocation of resources to Demand points in the best possible way using various techniques and minimize the cost or time of completion of number of jobs by number of persons.
4. Model competitive real-world phenomena using concepts from game theory. Analyse pure and mixed strategy games
5. Formulate Network models for service and manufacturing systems, and apply operations research techniques and algorithms to solve these Network problems

Unit	Content	60hrs
I	**Operations Research**-A quantitative approach to Decision Making, Features of OR, OR Approaches to Problem Solving, Methodology of Operations Research. **Linear programming:** Introduction, Structure of Linear Programming Model, Advantages, General Mathematical model of LPP, Examples of LP Model Formulation, Graphical solution methods of LP problem.	15
II	**Linear Programming:**The Simplex Method, Two-Phase method, Big M method **Duality in Linear Programming,** Formulation of Dual Linear Programming Problem and Examples.	15
III	**Assignment Problem:** Mathematical model of Assignment Problem, Hungarian method for solving Assignment problem. **Transportation Problem:** Transportation Problem, Mathematical model of Transportation Problem, Methods of finding Initial solution (North west corner rule, Least cost method, Vogel's Approximation method), Test for Optimality in TP using MODI method (uv -method).	15
IV	**Theory of Games:** Introduction, Two-person zero-sum game, pure strategies (Minmax and Maxmin principles),Mixed strategies, The rules principles of Dominance, Algebraic method to solve games without saddle point, Graphical method to solve the games. **Sequencing Problems:** Processing n jobs through two machines (Johnson's Procedure)	15

REFERENCES:

1. Operations Research Theory and Applications By JK Sharma, 5th Edition, MACMILLAN publishers India.
2.Operations Research – An Introduction, Taha H.A. –Low price Edition, 7th Edn,2006
3. Introduction to Operation Research, Hiller and Liberman, Mc Graw Hill. 5th edition 2001
4. Operation Research, Prem Kumar Gupta, D S Hira,S Chand pub, New Delhi, 2007.

Formative Assessment for Theory	
Assessment Occasion	**Marks**
Internal Assessment Test 1	10
Internal Assessment Test 1	10
Total	**20 Marks**
Formative Assessment as per guidelines	

DSC-21 Network Security

Type of Course	**Theory/ Practical**	**Credits**	**No. of hour per week Theory / Practical**	**Duration of Exam**	**Internal Assessment Marks Theory / Practical**	**Semester end Exam Marks**	**Total Marks**
DSC-21	Theory	4	4	3 hrs.	20	80	100

Course Outcomes: **Total hours:60**

1. Understand the development and implementation of security policy and procedures.
2. Understand the most common type of cryptographic algorithm
3. Understand the Public-Key Infrastructure
4. Able to understand Cryptographic Hash Functions
5. Able to configure simple firewall architectures

Unit	**Content**	**60hrs**
I	Basics of Information Security: NSTISSC(National Security Telecommunications and Information Systems Security Committee) security model, Components of an Information System, Securing components, Balancing Information Security and Access, Approaches to Information Security implementation; The Security System Development Life Cycle. Introduction; Information Security Policy, Standards, and Practices.	15
II	Classical Encryption Techniques : Symmetric Cipher Model-Cryptography, Cryptanalysis and Brute-Force Attack, Block Ciphers and the Data Encryption Standard - Traditional Block Cipher Structure- Stream Ciphers and Block Ciphers, Feistel Cipher Structure, The Data Encryption Standard-Encryption and Decryption, Advanced Encryption Standard-AES, International Data Encryption Algorithm(IDEA).	15
III	Public Key Cryptography : Public Key Cryptography and RSA Principles of Public-Key Cryptosystems-Public-Key Cryptosystems, Applications for	15

	Public-Key Cryptosystems, Requirements for Public-Key Cryptosystems, Public-Key Cryptanalysis, The RSA algorithm-Algorithm, Computational Aspects, The security of RSA, Other Public key cryptography algorithms-Diffie-Hellman Key Exchange.	
IV	Cryptographic Hash Functions : Cryptographic Hash Functions Applications of Cryptographic Hash Functions, Secure Hash Algorithms-SHA-512 Logic, Message Authentication Codes – Message Authentication Requirements, Message Authentication Functions Message Encryption, Message Authentication Code, Digital Signatures-Properties, Attacks and Forgeries, Digital Signature Requirements, Direct Digital Signature, Remote Authentication: KERBEROS.	15

Reference Books

1. Cryptography and Network Security, Principles And Practice Sixth Edition, William Stallings, Pearson.
2. Information Security Principles and Practice By Mark Stamp, Willy India Edition.
3. Cryptography & Network Security, Forouzan, Mukhopadhyay, McGrawHill
4. Cryptography and Network Security Atul Kahate, TMH.
5. Cryptography and Security, C K Shyamala, N Harini, T R Padmanabhan, Wiley-India.
6. Information Systems Security, Godbole, Wiley-India.

Formative Assessment for Theory	
Assessment Occasion	**Marks**
Internal Assessment Test 1	10
Internal Assessment Test 1	10
Total	**20 Marks**
Formative Assessment as per guidelines	

DSC-23 ARTIFICIAL INTELLIGENCE

Type of Course	Theory/ Practical	Credits	No. of hour per week Theory / Practical	Duration of Exam	Internal Assessment Marks Theory / Practical	Semester end Exam Marks	Total Marks
DSC-23	Theory	4	4	3 hrs.	20	80	100

Course Outcomes: **Total Hours : 60hrs**

1. To develop semantic-based and context-aware systems to acquire, organize process, share and use the knowledge embedded in multimedia content.
2. Research will aim to maximize automation of the complete knowledge lifecycle and achieve semantic interoperability between Web resources and services.
3. The field of Robotics is a multi-disciplinary as robots are amazingly complex system comprising mechanical, electrical, electronic H/W and S/W and issues germane to all these.

Unit	Content	60hrs
I	**Introduction:** History of Al - Intelligent agents - Structure of agents and its functions - Problem spaces and search - Heuristic Search techniques - Best-first search - Problem reduction - Constraint satisfaction - Means Ends Analysis.	15
II	**Knowledge Representation:** Approaches and issues in knowledge representation - Knowledge Based Agent - Propositional Logic - Predicate logic – Unification - Resolution - Waak slot - filler structure - Strong slot - filler structure.	15
III	**Reasoning under uncertainty:** Logics of non-monotonic reasoning – Implementation - Basic probability notation - Bayes rule - Certainty factors and rule based systems - Bayesian networks - Dempster - Shafer Theory - Fuzzy Logic. **Planning and Learning:** Planning with state space search - conditional planning - continuous planning - Multi-Agent planning. Forms of learning - inductive learning - Reinforcement Learning - learning decision trees - Neural Net learning and Genetic learning.	15
IV	**Advanced Topics: Game Playing:** Minimax search procedure - Adding alpha-beta cutoffs. **Expert System:** Representation - Expert System shells - Knowledge Acquisition. **Robotics:** Hardware - Robotic Perception - Planning - Application domains. **Swarm Intelligent Systems** - Ant Colony System, Development, Application and Working of Ant Colony System.	15

TEXT BOOKS

1. Elaine Rich, Kevin Knight and Shivashankar B. Nair, "Artificial Intelligence", Tata McGraw-Hill, Third edition, 2009. (UNIT's I, II, III & IV)
2. Stuart J. Russell and Peter Norvig, "Artificial Intelligence: A Modern Approach", Pearson Education Asia, Second edition, 2003. (UNIT III)
3. N. P. Padhy, "Artificial Intelligence and Intelligent System", Oxford University Press, Second edition, 2005. (UNIT IV)

REFERENCES

1. Rajendra Akerkar, "Introduction to Artificial Intelligence", Prentice-Hall of India, 2005.
2. Patrick Henry Winston, "Artificial Intelligence", Pearson Education Inc., Third edition, 2001.
3. Eugene Charniak and Drew Mc Dermott, "Introduction to Artificial Intelligence", Addison- Wesley, ISE Reprint, 1998.

Formative Assessment for Theory	
Assessment Occasion	**Marks**
Internal Assessment Test 1	10
Internal Assessment Test 1	10
Total	**20 Marks**
Formative Assessment as per guidelines	

Electives-I

DSC-17A: Block Chain Technologies

Type of Course	Theory/ Practical	Credits	No. of hour per week Theory / Practical	Duration of Exam	Internal Assessment Marks Theory / Practical	Semester end Exam Marks	Total Marks
DSC-17A	Theory	4	4	3 hrs.	20	80	100

Course Outcomes: **Total hours:60**

1. Describe the basic concepts and technology used for block chain.
2. Describetheprimitives of the distributed computing and cryptography related to blockchain.
3. Illustrate the concepts of Bitcoin and their usage.
4. Implement Ethereum blockchain contract.
5. Apply security features in blockchain technologies.
6. Use smart contract in real world applications.

Unit	Content	60hrs
I	**Introduction:** Need for Distributed Record Keeping, Modeling faults and adversaries, Byzantine Generals problem, Consensus algorithms and their scalability problems, Nakamoto's concept with Blockchain based cryptocurrency, Technologies Borrowed in Blockchain – hash pointers, consensus, byzantine fault-tolerant distributed computing, digital cash etc. **Basic Distributed Computing & Crypto primitives**: Atomic Broadcast, Consensus, Byzantine Models of fault tolerance, Hash functions, Puzzle friendly Hash, Collison resistant hash, digital signatures, public key crypto, verifiable random functions, Zero-knowledge systems.	15
II	**Bitcoin basics:** Bit coin block chain, Challenges and solutions, proof of work, Proof of stake, alternatives to Bit coin consensus, Bit coin scripting language and their use.	15
III	**Ethereum basics:** Ethereum and Smart Contracts, The Turing Completeness of Smart Contract Languages and verification challenges, Using smart contracts to enforce legal contracts, comparing Bitcoin scripting vs. Ethereum Smart Contracts, Writing smart contracts using Solidity & JavaScript.	15
IV	**Privacy, Security issues in Blockchain**: Pseudo-anonymity vs. anonymity, Zcash and Zk-SNARKS for anonymity preservation, attacks on Blockchains: Sybil attacks, selfish mining, 51% attacks advent of algor and; Sharding based consensus algorithms to prevent the seattacks.	15

Textbooks:

1. Mastering Blockchain by Imran Bashir, Publisher: Packt Publishing.
2. Blockchain Fundamental by Dr. Ravindra Vadapalli
3. Blockchain technology from theory to practice by Sudeep Tanwar.

References:

1. Narayanan, Bonneau, Felten, Millerand Goldfeder, "Bitcoin and Cryptocurrency Technologies –A Comprehensive Introduction," Princeton University Press.
2. Josh Thompson, 'Blockchain: The Blockchain for Beginnings, Guild to Blockchain Technology and Blockchain Programming,' CreateSpace Independent Publishing Platform,2017.
3. Imran Bashir, "Mastering Blockchain: Distributed ledger technology, decentralization, and smart contracts explained," Packt Publishing.
4. Merunas Grincalaitis, "Mastering Ethereum: Implement Advanced Blockchain Applications Using Ethereum-supported Tools, Services, and Protocols", Packt Publishing.
5. Prof. Sandip Chakraborty, Dr. Praveen Jayachandran, "Blockchain Architecture Design And Use Cases "[MOOC], NPTEL: https://nptel.ac.in/courses/106/105/106105184/.

Formative Assessment for Theory	
Assessment Occasion	**Marks**
Internal Assessment Test 1	10
Internal Assessment Test 1	10
Total	**20 Marks**
Formative Assessment as per guidelines	

DSC-17B: Mobile Communications

Type of Course	**Theory/ Practical**	**Credits**	**No. of hour per week Theory / Practical**	**Duration of Exam**	**Internal Assessment Marks Theory / Practical**	**Semester end Exam Marks**	**Total Marks**
DSC-17B	Theory	4	4	3 hrs.	20	80	100

Course Outcomes: **Total hours:60**

1. Discuss cellular radio concepts.
2. To have knowledge of the mobile system specifications.
3. Classify frequency and handoff management techniques in mobile communication.
4. Outline cellular mobile communication standards.
5. Analyze various methodologies to improve the cellular capacity.

Unit	**Content**	**60hrs**
I	Introduction: Wireless Communication Systems, Applications of Wireless Communication Systems, Types of Wireless Communication Systems, Trends in Mobile Communication Systems 05L UNIT-02. Cellular Mobile Systems: Basic Cellular Systems, Performance Criteria, Uniqueness of Mobile Radio Environment, Operation of Cellular Systems, Analog& Digital Cellular Systems. Introduction: Wireless Communication Systems, Applications of Wireless Communication Systems, Types of Wireless Communication Systems, Trends in Mobile Communication Systems. Cellular Mobile Systems: Basic Cellular Systems, Performance Criteria, Uniqueness of Mobile Radio Environment, Operation of Cellular Systems, Analog& Digital Cellular Systems Cellular Mobile Systems: Basic Cellular	15

	Systems, Performance Criteria, Uniqueness of Mobile Radio Environment, Operation of Cellular Systems, Analog& Digital Cellular Systems	
II	Elements of Cellular Radio System Design: Concept of Frequency Reuse Channels, Co-channel Interference Reduction Factor, Desired C/I From a Normal Case in an Omnidirectional Antenna System, Handoff Mechanism, Cell Splitting. Interference in Cellular Mobile System: Co-channel Interference, Design of an Omnidirectional Antenna System in the Worst Case, Design of a Directional Antenna System, Lowering the Antenna Height, Power Control, Reduction in C/I by Tilting Antenna, Umbrella Pattern Effect, Adjacent-Channel Interference, Near-end, Far-end Interference, Effect on Near-end Mobile Units.	15
III	Frequency Management, Channel Assignment and Handoffs: Frequency Management, Frequency-Spectrum Utilization, Set-up Channels, Fixed Channel Assignment Schemes, Non-Fixed Channel Assignment Schemes, Concept of Handoff, Initiation of a Hard Handoff, Delaying a Handoff, Forced Handoffs, Queuing of Handoffs, Power Difference Handoffs, Mobile Assisted Handoff, Soft Handoffs, Cell-site Handoff, Intersystem Handoff, Dropout Calls.	15
IV	GSM System Overview: GSM System Architecture, GSM Radio Subsystem, GSM Channel Types, Frame Structure for GSM, Signal Processing in GSM, GPRS and EDGE. Wireless Networks: Overview of Wi-Fi, WiMAX and Bluetooth Technology: Basic Features and Physical Specifications.	15

Books and References

1. Mobile Cellular Telecommunications: Analog and Digital Systems by W. C. Y. Lee; Tata McGraw Hill Publication.
2. Wi-Fi, Bluetooth, Zigbee and WiMax by H. Labiod, H. Afifi and C. D. Santis, Springer.
3. Wireless Communications: Principles and Practice by T. S. Rappaport; Pearson Publication.
4. Wireless Communications and Networks: 3G and Beyond by I. S. Misra; Tata McGraw Hill Publication.
5. Wireless and Digital Communications by K. Feher; PHI Publication

Formative Assessment for Theory	
Assessment Occasion	**Marks**
Internal Assessment Test 1	10
Internal Assessment Test 1	10
Total	**20 Marks**
Formative Assessment as per guidelines	

DSC-17C: Cloud Computing

Type of Course	Theory/ Practical	Credits	No. of hour per week Theory / Practical	Duration of Exam	Internal Assessment Marks Theory / Practical	Semester end Exam Marks	Total Marks
DSC-17C	Theory	4	4	3 hrs.	20	80	100

Course Outcomes: **Total hours:60**

1. Explain the core concept of the cloud computing paradigm.
2. Apply the fundamental concepts in data centers to understand the trade-offs in power.
3. Identify resource management fundamentals.
4. Analyze various cloud programming models and apply them to solve problems on cloud.

Unit	Content	60hrs
I	**Cloud Computing Basics**: Overview, Applications, Intranet and the Cloud, First Movers in the Cloud; The Use of Cloud Computing, Benefits, Security concerns, regulatory issues; Overview of different cloud computing applications that are implemented; Business case for implementing a Cloud: Cloud Computing Services, Applications help to the business, deleting the data center, Saleforce.com, Thomson Reuters.	15
II	**Cloud Computing Technology**: Hardware and Infrastructure: Clients, Security, Network, Services; Accessing the Clouds: Platforms, Web applications, Web APIs, Web Browsers.	15
III	**Cloud Storage:** Overview, Cloud Storage providers, Standards: Applications, Client, Infrastructure, Services.	15
IV	**Cloud Computing at Work:** Software as a service: Overview, Driving Forces, Company offerings, Industries; Software plus services: Overview, Mobile Device Integration, Providers, Microsoft Online; Developing Applications: Google, Microsoft, Intuit QuickBase, Cast Iron Cloud, Bungee Connect, Development: Google, Sales Force, Azure. Local Clouds and Thin Clients: Virtualization, server solutions, Thin Clients; Migrating to the clouds:	15

Text Books:

1. Cloud Computing a Practical approach, Anthony T Velte, Toby J Velte, Robert Elsenpeter, Tata McGraw-Hill, 2010 Edition.

Reference Books:

1. Mastering Cloud Computing, Rajkumar Buyya, Christian Vecchiola, S. Thamari Selvi, McGraw Hill Education (India) Private Limited.
2. Distributed and Cloud Computing, Kai Hwang, Geoffrey C. Fox, Jack J. Dongarra, Morgan Kaufmann Publishers 2012.
3. Cloud computing, Barrie Sosinsky, Wiley India.
4. Cloud Computing, Kumar Saurabh, 2nd Edition, Wiley, India

Formative Assessment for Theory	
Assessment Occasion	**Marks**
Internal Assessment Test 1	10
Internal Assessment Test 1	10
Total	**20 Marks**
Formative Assessment as per guidelines	

Electives-II

DSC 22A: DEEP LEARNING

Type of Course	Theory/ Practical	Credits	No. of hour per week Theory / Practical	Duration of Exam	Internal Assessment Marks Theory / Practical	Semester end Exam Marks	Total Marks
DSC-22A	Theory	4	4	3 hrs.	20	80	100

Course Outcomes: **Total hours:60**

1. Able to explain the various learning models to solve real world problems.
2. Able to describe the various Neural Network Architectures
3. Analyze and design Deep learning algorithms in different applications.
4. Understand and Apply CNN and RNN techniques to different applications.

Unit	Content	60hrs
I	Introduction: Historical context and motivation for deep learning; basic supervised classification task, optimizing logistic classifier using gradient descent, stochastic gradient descent, momentum, and adaptive sub-gradient method. Neural Networks: Feed forward neural networks, deep networks, regularizing a deep network, model exploration, and hyper parameter tuning.	15
II	Optimization for training deep models: Challenges in Neural Network optimization, Basic Algorithms, Parameter Initialization Strategies, Algorithm with Adaptive Learning Rates, Approximate second order Methods, Optimization Strategies and Meta-Algorithms.	15
III	Convolutional Networks and Sequence Modeling: Motivation, Convolution operation, Pooling, Variants of the Basic Convolution Function, Structured outputs, Efficient Convolution Algorithms. Sequence Modeling: Recurrent Nets Unfolding computational graphs, recurrent neural networks (RNNs), bidirectional RNNs, encoder-decoder sequence to sequence architectures, deep recurrent networks, Recursive neural networks.	15
IV	Auto encoders: Under complete auto encoders, regularized auto encoders, sparse auto encoders, denoising auto encoders, representational power, layer, size, and depth of auto encoders, stochastic encoders and decoders, denoising auto encoders, Learning manifolds with Auto encoders, Applications of Auto encoders.	15

References:

1. Ian Good fellow, Yoshua Bengio, Aaron Courville, "Deep Learning", MIT Press, 2016.
2. Jeff Heaton, "Deep Learning and Neural Networks", Heaton Research Inc, 2015.
3. Deng & Yu, "Deep Learning: Methods and Applications", Now Publishers, 2013.
4. Nikhil Buduma, Nicholas Locascio, "Fundamentals of Deep Learning: Designing NextGeneration Machine Intelligence Algorithms", O'ReillyMedia, 2017.
5. Mindy L Hall, "Deep Learning", VDM Verlag, 2011.

Formative Assessment for Theory	
Assessment Occasion	**Marks**
Internal Assessment Test 1	10
Internal Assessment Test 1	10
Total	**20 Marks**
Formative Assessment as per guidelines	

DSC 22B: Internet of Things

Type of Course	Theory/ Practical	Credits	No. of hour per week Theory / Practical	Duration of Exam	Internal Assessment Marks Theory / Practical	Semester end Exam Marks	Total Marks
DSC-22B	Theory	4	4	3 hrs.	20	80	100

Course Outcomes: **Total hours:60**

1. Demonstrate basic concepts, principles and challenges in IoT.
2. Illustrate functioning of hardware devices and sensors used for IoT.
3. Analyze network communication aspects and protocols used in IoT.
4. Apply IoT for developing real life applications using Ardunio programming.
5. To develop IoT infrastructure for popular applications.

Unit	Content	60hrs
I	Internet of Things (IoT): Vision, Definition, Conceptual Framework, Architectural view, technology behind IoT, Sources of the IoT, M2M Communication, IoT Examples. Design Principles for Connected Devices: IoT/M2M systems layers and design standardization, communication technologies, data enrichment and consolidation, ease of designing and affordability.	15
II	Hardware for IoT: Sensors, Digital sensors, actuators, radio frequency identification (RFID) technology, wireless sensor networks, participatory sensing technology. Embedded Platforms for IoT: Embedded computing basics, Overview of IOT supported Hardware platforms such as Arduino, NetArduino, Raspberry pi, Beagle Bone, Intel Galileo boards and ARM cortex.	15
III	Network and Communication aspects in IoT: Wireless Medium access issues, MAC protocol survey, Survey routing protocols, Sensor deployment & Node discovery, Data aggregation & dissemination. Programming the Ardunio: Ardunio Platform Boards Anatomy, Ardunio IDE, coding, using emulator, using libraries, additions in ardunio, programming the ardunio for IoT.	15
IV	Challenges in IoT Design challenges: Development Challenges, Security Challenges, Other challenges IoT Applications: Smart Metering, E-health, City Automation, Automotive Applications, home automation, smart cards, communicating data with H/W units, mobiles, tablets, Designing of smart street lights in smart city.	15

Reference Books

1. Olivier Hersent,DavidBoswarthick, Omar Elloumi"The Internet of Things key applications and protocols", willey
2. Jeeva Jose, Internet of Things, Khanna Publishing House
3. Michael Miller "The Internet of Things" by Pearson
4. Raj Kamal "INTERNET OF THINGS", McGraw-Hill, 1ST Edition, 2016
5. ArshdeepBahga, Vijay Madisetti "Internet of Things (A hands on approach)" 1ST edition, VPI publications,2014
6. Adrian McEwen,Hakin Cassimally "Designing the Internet of Things" Wiley India

Formative Assessment for Theory	
Assessment Occasion	**Marks**
Internal Assessment Test 1	10
Internal Assessment Test 1	10
Total	**20 Marks**
Formative Assessment as per guidelines	

DSC 22C: Soft Computing

Type of Course	Theory/ Practical	Credits	No. of hour per week Theory / Practical	Duration of Exam	Internal Assessment Marks Theory / Practical	Semester end Exam Marks	Total Marks
DSC-22C	Theory	4	4	3 hrs.	20	80	100

Course Outcomes

Total:60hrs

1. Describe and understand the concepts of feed forward & feedback neural networks
2. Recognize the concept of fuzziness involved in various systems
3. Expose the ideas about genetic algorithm
4. Compare about FLC and NN toolbox
5. Design algorithm for optimization problem

Unit	Content	60hrs
I	**Introduction:** Introduction of soft computing - soft computing vs. hard computing - various types of soft computing techniques - applications of soft computing Neuron-Nerve structure and synapse - Artificial Neuron and its model - activation functions - Neural network architecture - single layer and multilayer feed forward networks - McCulloch Pitts neuron model - perceptron model – MLP - back propagation learning methods - effect of learning rule coefficient.*	15
II	**Architecture:** Counter propagation network architecture - functioning & characteristics of counter - Propagation network - Hopfield/Recurrent -	15

	network - configuration - stability constraints - associative memory – characteristics - limitations and applications - Hopfield v/s Boltzman machine - Adaptive Resonance Theory Architecture – classifications - Implementation and training - Associative Memory.* Different faces of imprecision – inexactness – Ambiguity – Undecidability - Fuzziness and certainty - Fuzzy sets and crisp sets - Intersections of Fuzzy sets - Union of Fuzzy sets - the complement of Furzy sets - Fuzzy reasoning - Linguistic variables - Fuzzy propositions - Fuzzy compositional rules of inference - Methods of decompositions and defuzzification.*	
III	**Optimization Algorithm:** Basic concept of Genetic algorithm and detail algorithmic steps - adjustment of free Parameters - Solution of typical control problems using genetic algorithm - Concept on some other search techniques like tabu search and ant colony - search techniques for solving optimization problems.*	15
IV	**MATLAB Tool Box for FUZZY Logic and Neural Network:** GA application to optimization problems - Case studies: Identification and control of linear and nonlinear dynamic systems using MATLAB - Neural Network toolbox - Stability analysis of Neural Network interconnection systems - Implementation of fuzzy logic controller using MATLAB fuzzy logic toolbox - Stability analysis of fuzzy control systems.*	15

Text Books

1. Timothy J. Ross, "Fuzzy Logic with Engineering Applications", Third Edition, Wiley India, 2012.
2. Zimmermann H. J., "Fuzzy Set Theory and its Applications", Springer International Edition, 2011.

Reference Books

1. David E. Goldberg, "Genetic Algorithms in Search, Optimization, and Machine Learning", Pearson Education, 2009.
2. Laurene V. Fausett, "Fundamentals of Neural Networks: Architectures, Algorithms, and Applications", First Edition, Pearson Education, 1993.
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Formative Assessment for Theory	
Assessment Occasion	**Marks**
Internal Assessment Test 1	10
Internal Assessment Test 1	10
Total	**20 Marks**
Formative Assessment as per guidelines	