KARNATAK UNIVERSITY, DHARWAD
ACADEMIC (S&T) SECTION

ಕರ್ನಾಟಕ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಧಾರವಾಡ
ವಿದ್ಯಾಮಂಡಳ (ಎಸ್&ಟಿ) ವಿಭಾಗ

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NAAC Accredited 'A' Grade 2014

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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 ಭಿತ್ತರಿಸಲಾಗಿದನ್ನು 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 ಅನಾಲೆಸಿಸ್ಟ / 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. ಅಂರ್ತಜಾಲದಲ್ಲಿ ಪ್ರಕಟಿಸುವುದು.

KARNATAK UNIVERSITY, DHARWAD

P.G. Studies in

MASTER OF COMPUTER SCIENCE

(M.Sc. (CS))

(I-IV Semester)

Curriculum Structure

With Effect From
2024-25 onwards

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. 5th 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	

M.Sc. Computer Science
Academic Year 2024-25

Sem.	Type of Course	Theory/ Practical	Course Code	Course 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	A1CSC001T	Python Programming	4	4	3 hrs.	20	80	100
	DSC -2	Theory	A1CSC002T	Probability and Statistics	4	4	3 hrs.	20	80	100
	DSC -3	Theory	A1CSC003T	Digital Logic and Computer Design	4	4	3 hrs.	20	80	100
	DSC -4	Theory	A1CSC004T	Advanced Data Structures	4	4	3 hrs.	20	80	100
	DSC -5	Theory	A1CSC005T	Introduction to Algorithms	4	4	3 hrs.	20	80	100
	DSC-6	Practical	A1CSC006P	Python Programming Lab	2	4	3 hrs.	10	40	50
	DSC-7	Practical	A1CSC007P	Advanced Data Structure Lab	2	4	3 hrs.	10	40	50
II	DSC-8	Theory	A2CSC008T	Theory of Computation	4	4	3 hrs.	20	80	100
	DSC-9	Theory	A2CSC009T	Design and Analysis of Algorithms	4	4	3 hrs.	20	80	100
	DSC-10	Theory	A2CSC010T	Advanced DBMS	4	4	3 hrs.	20	80	100
	DSC-11	Theory	A2CSC011T	Web Technologies	4	4	3 hrs.	20	80	100
	DSC-12	Practical	A2CSC012P	DBMS Lab	2	4	3 hrs.	10	40	50
	DSC-13	Practical	A2CSC013P	Web Technologies Lab	2	4	3 hrs.	10	40	50
	OEC-1	Theory	A2CSC2001T	Cyber Security and Cyber laws	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	A3CSC014T	Linear Algebra	4	4	3 hrs.	20	80	100
	DSC-15	Theory	A3CSC015T	Electives-I	4	4	3 hrs.	20	80	100
	DSC-16	Theory	A3CSC016T	Data mining	4	4	3 hrs.	20	80	100
	DSC-17	Theory	A3CSC017T	Computer Graphics	4	4	3 hrs.	20	80	100
	OEC-2	Theory	A3CSC2002T	Problem solving technics Python Programming	4	4	3 hrs.	20	80	100
	DSC-18	Practical	A3CSC018P	Data mining Lab	2	4	3 hrs.	10	40	50
	DSC-19	Practical	A3CSC019P	Computer Graphics Lab	2	4	3 hrs.	10	40	50
IV	DSC-20	Theory	A4CSC020T	Software Engineering	4	4	3 hrs.	20	80	100
	DSC-21	Theory	A4CSC021T	Operating System	4	4	3 hrs.	20	80	100
	DSC-22	Theory	A4CSC022T	Artificial Intelligence and Machine Learning	4	4	3 hrs.	20	80	100
	DSC-23	Theory	A4CSC023T	Electives-II	4	4	3 hrs.	20	80	100
	DSC-24	Practical	A4CSC024p	Artificial Intelligence and Machine Learning Lab	2	4	3 hrs.	10	40	50
	DSC-25	Project	A4CSC025P	Project	6	12	-	50	100	150

Electives-I:
1. DSC-15A : Computer Networks
2. DSC-15B : Deep Learning
3. DSC-15C : Mobile Communications
4. DSC-15D : Operation Research

Electives-II:
1. DSC-23A: Network Security
2. DSC-23B: Digital Image processing
3. DSC-23C: IOT
4. DSC-23D: 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	15

	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, 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 PROBABILITY AND STATISTICS

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

Total Hours: 60

Course Outcomes

1. To study the basics of statistics, measure central tendency and dispersion.
2. Develop statistical methods for correlation, regression analysis and curve fitting.
3. Explore the principles of probability.
4. Understand the principles of probability distribution.
5. Explain the sampling theory, errors and chi distribution.

Unit	Content	60hrs
I	**Probability :** Sample space and Events - Probability -The Axioms of probability - some Elementary Theorems - Conditional probability -Baye's Theorem - Random variables – Discrete and continuous probability distributions. **Distributions** Binomial, Poisson and normal Distributions, related properties. Sampling Distributions – Sampling Distribution of means.	15
II	**Estimation** Point Estimation - Interval Estimation – Introduction to student's t-distribution - Confidence interval for Single Mean and Single Proportion (Large and Small samples).	15
III	**Testing of Hypothesis-I :** Testing of hypothesis-Introduction- Null hypothesis-Alternative hypothesis- Type I and Type II errors – Critical region. Test of hypotheses for Single Mean (Large and small samples) - Test of hypotheses for Single Proportion (Large and small samples). **Testing of Hypothesis-II:** Tests of hypotheses for difference of Means (Large and Small samples) - Tests of hypotheses for difference of proportions(Large samples) – Introduction to Chi-Square distribution and Goodness of Fit.	15
IV	**Correlation & Regression:** Coefficient of correlation- Regression Coefficient- The lines of regression- The rank correlation.	15

References

1. Probability & Statistics, T.K.V.Iyengar, B. Krishna Gandhi & Others,3ed, S.Chand & Co,2011
2. Probability & Statistics, D. K. Murugesan, P. Guru Swamy, 1ed, Anuradha Publications,2011
3. Probability & Statistics for Engineers, G.S.S. Bhishma Rao, 2ed,Scitech Publications, 2005

4. Probability & Statistics for Engineers, Miller, John E. Freund, 8ed, Prentice Hall of India,2010
5. A first course in Probability & Statistics, B.L.S.Prakasa Rao, 1ed, World Scientific,2010
6. Fundamentals of Mathematical Statistics, S.C. Gupta, V.K.Kapoor,11 ed, S.Chand & Co.,2003

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 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 -3	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.	15

	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.	
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-4 : Advanced Data Structures

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 Outcome: **Total Hours: 60**

1. Understand the basic concept of various data structures with their classifications.
2. Implement Stack and Queue by performing different operations on them.
3. Implement Linked Lists by performing different operations on them.
4. Perform various operations on non-linear data structures.
5. Implement various Hashing techniques.

Unit	Content	60hrs
I	Introduction to Data Structure Data Management concepts, Data Types (Primitive & Non-primitive), classification of data structures. Performance Analysis and Measurement (Time and Space Analysis of Algorithms - Average, Best and Worst Case Analysis), Types of Data Structures (Linear & Non Linear Data Structures) Array: Representation of Array, Sparse Matrix and its Representation, Pointer Overview, Applications of Array.	15
II	Linear Data Structures : Stack and Queue Stack: Definitions & Concepts, Operations on Stack, Applications of Stack : Polish Expression and their Compilation, Conversion of Infix Expression to Polish Notations, Evaluation of Polish Expressions, Recursion Queue: Representation of Queue, Operations on Queue, Circular Queue, Priority Queue, Double Ended Queue, Applications of Queue.	15
III	Linked List Singly Linked List: Representation of Singly Linked List, Operations on Singly Linked List, Insert a node at the beginning of the list, Insert a node at the end of the list, Insert a node at the specific location, Insert a node such that it preserves the ordering of data in the increasing order, Delete the first node, Delete the last node, Delete the specified node, Search the particular element, Sort the list, Traverse the list. Doubly Linked List: Representation of Doubly Linked List, Operations of Doubly Linked List, Insert a node at the beginning of the list, Insert a node at the end of the list, Insert a node at the specific location, Insert a node such that it preserves the ordering of data in the increasing order, Delete the first node, Delete the last node, Delete the specified node, Search the particular element. Circular Linked List: Representation of Circular Linked List, Insertion and Deletion of the node in the list Implementation of Stack using Linked list, Implementation of Queue using Linked list, Applications of Linked List.	15

IV	Nonliner Data Structures : Tree: Definitions and Concepts, Representation of Binary Tree, Binary Tree Traversal (Inorder, Postorder & Preorder Traversal), Threaded Binary Tree, Binary Search Tree (BST), Conversion of General Tree to Binary Tree, Balanced Trees - Height Balanced Tree (AVL Tree, 2-3 Tree), Weight Balance Tree, Multiway Search Tree (B-Tree), Red Black trees, Applications of Tree. Hashing: The Hash Table, Hashing Functions, Collision-Resolution Techniques.	15

Reference Books

1. An Introduction to Data Structures with Applications by Jean-Paul Tremblay & Paul G. Sorenson | Tata McGraw Hill.
2. Data Structures using C and C++ by Ten Baum Prenctice-Hall International .
3. Fundamentals of Computer Algorithms by Ellis Horowitz, Sartaj Sahni, Sanguthever Rajasekaran | Universities Press (India) Private Limited | Ed. 2001
4. Fundamentals of Data Structures in C++ by Sartaj Sahani.
5. Data Structures using C by Reema Thareja.

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 Introduction to 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 -5	Theory	4	4	3 hrs.	20	80	100

Course Outcomes **Total Hours: 60**

1. Understand the fundamental concepts of computers, algorithms, flowcharts and problem solving techniques.
2. Apply the basic knowledge of mathematical factoring methods to model an algorithm, flowchart for a given problem.
3. Apply merging, sorting, searching and text processing techniques to develop algorithms.
4. Analyze the given problem, use appropriate array technique and write an effective report.

Unit	Content	60hrs
I	**Introduction to Computer Problem Solving** Introduction, The Problem-solving Aspect, Top- down Design, Implementation of Algorithms, Program Verification, The Efficiency of Algorithms, The Analysis of Algorithms. **Fundamental Algorithms** Introduction, Exchange of Values of Two Variables, Counting, Summation of a Set of Numbers, Factorial Computation, Sine Function Computation, Generation of the Fibonacci sequence, Reversing the Digits of an Integer, Base Conversion, Character to Number Conversion	15
II	**Factoring Methods** Introduction, Finding the Square Root of a Number, The Smallest Division of an Integer, The Greatest Common Divisor of Two Integers, Generating Prime Numbers, Computing the Prime Factors of an Integer, Generation of Pseudo-random Numbers, Raising a Number to a large Power, Computing the nth Fibonacci number	15
III	**Array Techniques** Introduction, Array Order Reversal, Array Counting or Histogram Ming, Finding the Maximum Number in a Set, Removal of Duplicates from an Ordered Array, Partitioning an Array, Finding the kth Smallest Element, Longest Monotone Subsequence	15
IV	**Merging, Sorting and Searching** Introduction, the Two-way Merge, sorting by Selection, sorting by Exchange, sorting by Insertion, sorting by Diminishing Increment, Sorting by Partitioning, Binary Search. **Recursive Algorithms** Introduction, Binary Tree Traversal, Recursive Quick sort, Towers of Hanoi Problem, Sample Generation, Combination Generation, Permutation Generation.	15

Reference:

1. How To Solve It By Computer by R. G. Dromey, Fifteenth Ed 2014
2. Algorithms and Data Structures: N. Wirth 1985 Oberon version: August 2004.
3. Algorithmic graph theory by Alan Gibbons, Cambridge University Press.
4. Introduction to Algorithms, by T. Cormen , C. Leiserson , R. Rivest , C Stein, 3Ed. International Edition, MIT Press,2009.
5. Graph Theory : Modeling, Applications and Algorithms by Geir Agnarsson,1st Edition,2008.

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 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-8	Theory	4	4	3 hrs.	20	80	100

COURSE OUTCOME: **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,

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 : 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-9	Theory	4	4	3 hrs.	20	80	100

Course Outcomes: **Total Hrs.: 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	15

	Greedy Strategy, Minimum Spanning trees (Kruskal's algorithm, Prim's algorithm), Graphs: Shortest paths, The Knapsack Problem, Job Scheduling Problem, Huffman code.	
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-10 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-10	Theory	4	4	3 hrs.	20	80	100

Course Outcomes **Total Hrs.: 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 Modeling 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 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	20
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	15

	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	
IV	Enhanced Data Models: Introduction to Active, Temporal, Spatial, Multimedia and Deductive Databases Active Databases Concepts and Triggers, Temporal Database Concepts Spatial Database Concepts, **Overview of Data Warehousing and OLAP** Introduction, Definitions, and Terminology2Characteristics of Data Warehouses, Data Modeling for Data Warehouses, Building a Data Warehouse Typical Functionality of a Data Warehouse Data Warehouse versus Views	10

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-11 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-11	Theory	4	4	3 hrs.	20	80	100

Course Outcome **Total Hours:60hrs**

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	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 Definition (DTD), XML schema Definition (XSD); XSD Simple Types, XSD attributes' XSD complex types, XML Style Sheets (XSLT), Xquery	15
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.	15

	Introduction to anguler 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.	

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	

OEC-1: Cyber Security and cyber laws

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. Understand and illustrate cyber security concepts and principles.
2. Analyze the working of cyber security principles to system design.
3. Apply appropriate techniques to solve cyber security threats.
4. To get the knowledge about the Cyber Law related with internet.

Unit	Content	60hrs
I	Introduction to Cyber Security, Defining Cyberspace and Cyber security, Standards of Good Practice for Information Security, ISO Suite of Information Security Standards, NIST Cyber security Framework and Security Documents, CIS Critical Security Controls for Effective Cyber Defense, COBIT 5 for Information Security, Payment Card Industry Data Security Standard.	15
II	System Access System Access Concepts, User Authentication, Password-Based Authentication, Possession-Based Authentication, Biometric Authentication, Risk Assessment for User Authentication, Access Control, Customer Access. Threat and Incident Management Technical Vulnerability Management, Security Event Logging, Security Event Management, Threat Intelligence, Cyber Attack Protection.	15
III	Phishing and Identity Theft Introduction, Phishing - Methods of Phishing, Phishing Techniques, Phishing Toolkits and Spy Phishing. Identity Theft – PII, Types of Identity Theft, Techniques of ID Theft. Digital Forensics Science, Need for Computer Cyber forensics and Digital Evidence, Digital Forensics Life Cycle.	15
IV	Cyber laws to be covered as per IT 2008: Definitions, Digital Signature and Electronic Signature, [Section 43] Penalty and Compensation for damage to computer, computer system, etc.[Section 65] Tampering with Computer Source Documents, [Section 66 A] Punishment for sending offensive messages through communication service, [Section 66 B] Punishments for dishonestly receiving stolen computer resource or communication device.	15

Reference Books:

1. William Stallings, Effective Cyber Security: A Guide to Using Best Practices and Standards, Addison Wesley Professional, ISBN-13: 978-0134772806.
2. Nina Godbole & SunitBelapure, Cyber Security, Wiley India, 2012, ISBN: 9788126521791.
3. Mike Shema, Anti-Hacker Tool Kit (Indian Edition), 4th Edition, Publication McGraw Hill, ISBN: 9789339212155.
4. Nina Godbole and Sunit Belpure, Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Wiley Publication, ISBN 9788126521791.
5. Rodney D. Ryder, "Guide to Cyber Laws", Second Edition, Wadhwa And Company
6. K.Kumar," Cyber Laws: Intellectual property & E Commerce, Security

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	

III - Semester
DSC-14 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-14	Theory	4	4	3 hrs.	20	80	100

Course Outcomes **Total:60hrs**

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-16 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-16	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	15

	test conditions, Measures for Selecting the Best Split, Algorithm for Decision 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	

DSC-17 Computer 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-17	Theory	4	4	3 hrs.	20	80	100

Course Outcomes **Total:60hrs**

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, Scaling, Rotation, Viewing Transformation, The Perspective, Algorithms, Three Dimensional Clipping, Perspective view of Cube.	15
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 onsegments. 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	

OEC-2: Problem Solving technics using Python Programming(OEC)

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:60hrs**

1. Introduction to computers, classification of computers, anatomy of computer, constituents, Number systems and Boolean algebra.
2. Familiar with Python environment, data types, operators used in Python.
3. Compare and contrast Python with other programming languages.
4. Learn the use of control structures and numerous native data types with their methods.
5. Design user defined functions, modules, and packages and exception handling methods.
6. Identify the methods to create and manipulate lists, dictionaries, tuples and sets.

Unit	Content	60hrs
I	Introduction to Computers - Computer Definition, Characteristics of Computers, Types of Computers, Basic Organization of a Digital Computer; Number Systems – different types, Computer Codes – BCD, Gray Code, ASCII and Unicode; Boolean Algebra – Boolean Operators with Truth Tables; Types of Software – System Software and Utility Software; Computer Languages - Machine Level, Assembly Level & High Level Languages, Translator Programs – Assembler, Interpreter and Compiler; Planning a Computer Program - Algorithm, Flowchart and Pseudo code with Examples.	15
II	Introduction to Features and Applications of Python; Python Versions; Installation of Python; Python Command Line mode and Python IDEs; Simple Python Program. Identifiers; Keywords; Statements and Expressions; Variables; Operators; Precedence and Association; Data Types; Indentation; Comments; Built-in Functions- Console Input and Console Output, Type Conversions; Python Libraries; Importing Libraries with Examples; Illustrative programs.	15
III	**Python Control Flow:** Types of Control Flow; Control Flow Statements- if, else, elif, while loop, break, continue statements, for loop Statement; range() and exit () functions; Illustrative programs. **Python Functions:** Types of Functions; Function Definition- Syntax, Function Calling, Passing Parameters/arguments, the return statement; Default Parameters; Command line Arguments; Key Word Arguments; Illustrative programs.	15

IV	**Strings:** Creating and Storing Strings; Accessing Sting Characters; the str() function; Operations on Strings- Concatenation, Comparison, Slicing and Joining, Traversing; Format Specifiers; Escape Sequences; Raw and Unicode Strings; Python String Methods; Illustrative programs. **Lists:** Creating Lists; Operations on Lists; Built-in Functions on Lists; Implementation of Stacks and Queues using Lists; Nested Lists. **Dictionaries:** Creating Dictionaries; Operations on Dictionaries; Built-in Functions on Dictionaries; Dictionary Methods; Populating and Traversing Dictionaries. **Tuples and Sets:** Creating Tuples; Operations on Tuples; Built-in Functions on Tuples; Tuple Methods; Creating Sets; Operations on Sets; Built-in Functions on Sets; Set Methods.	15

References

1. Computer Fundamentals (BPB), P. K. Sinha & Priti Sinha
2. Introduction to Python Programming, Gowrishankar S et al., CRC Press, 2019.
3. Python Data Analytics: Data Analysis and Science Using Pandas, matplotlib, and the Python Programming Language, Fabio Nelli, Apress®, 2015
4. Advance Core Python Programming, MeenuKohli, BPB Publications, 2021.
5. Core PYTHON Applications Programming, Wesley J. Chun, 3rd Edition, Prentice Hall, 2012.

Web references

- http://www.ibiblio.org/g2swap/byteofpython/read/
- http://scipy-lectures.org/intro/language/python_language.html
- https://docs.python.org/3/tutorial/index.html

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	

IV Semester

DSC-20 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-20	Theory	4	4	3 hrs.	20	80	100

Course Outcomes **Total:60hrs**

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. Analyzing 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	15

	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	

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-21 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-21	Theory	4	4	3 hrs.	20	80	100

Course Outcomes **Total:60hrs**

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, inter process 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	

DSC-22 Artificial Intelligence and 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-22	Theory	4	4	3 hrs.	20	80	100

Course Outcomes **Total:60hrs**

1. Explain the fundamental concepts and techniques of artificial intelligence and intelligent agents.
2. Apply various search algorithms and game-playing strategies to solve complex problems.
3. Represent knowledge using logical agents, propositional logic, and first-order predicate calculus.
4. Develop planning algorithms and understand their applications in AI problem-solving.
5. Analyze applications of artificial intelligence in fields such as natural language processing, speech recognition, and computer vision.

Unit	**Content**	**60hrs**
I	Introduction: Introduction to AI applications and AI techniques, Production systems, control strategies, reasoning- forward and backward chaining. Intelligent Agents: Definitions of a rational agent, reflex, model-based, goal-	15

	based, and utility-based agents, the environment in which a particular agent operates. Problem solving: Problem-solving Agents and examples on problems.	
II	Searching Techniques and Game Playing: Breadth first search, depth first search, iterative deepening, uniform cost search, hill climbing, simulated annealing, genetic algorithm search, heuristic search, Best first search, A* algorithm, AO* algorithm, Minimax and game trees, refining minimax, Alpha - Beta pruning, constraint satisfaction. Adversarial Search: Games, optimal decisions in games, stochastic games.	15
III	Knowledge Representation: Logical Agents: Knowledge-Based Agents, Logic, propositional logic First order predicate calculus, resolution, unification, natural deduction system, refutation, logic programming, PROLOG, semantic networks, frame system, value inheritance, conceptual dependency, Ontologies. Planning: basic representation for planning, symbolic-centralized vs. reactive- distributed, partial order planning algorithm.	15
IV	Machine learning: Introduction to different types of learning, Supervised and Unsupervised learning — Reinforcement learning- Basics of Neural network models. Applications of Artificial Intelligence- Natural Language Processing, Speech recognition, Computer vision, Expert systems.	15

REFERENCE:

1. S. Russell and P. Norvig, Artificial Intelligence: A Modern Approach (3rd ed.),Pearson Education, 2010.
2. Elaine Rich and Kelvin Knight, Artificial Intelligence, Tata McGraw Hill,2002.
3. Nils J Nilson, Artificial Intelligence: A New Synthesis, Morgan Kaufmann Publishers, Inc., San Francisco, California, 2000.

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-15A 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
DSC-15A	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	

DSC-15B 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-15B	Theory	4	4	3 hrs.	20	80	100

Course Outcomes **Total:60hrs**

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	15

	Methods, Optimization Strategies and Meta-Algorithms.	
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-15C Mobile Communication

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-15D	Theory	4	4	3 hrs.	20	80	100

Course Outcomes **Total:60hrs**

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. 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 Systems, Performance Criteria, Uniqueness of Mobile Radio Environment, Operation of Cellular Systems, Analog& Digital Cellular Systems	15
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	15

	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.	

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-15D 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-15C	Theory	4	4	3 hrs.	20	80	100

Course Outcomes **Total:60hrs**

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	

Electives-II

DSC-23A Information and 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-23A	Theory	4	4	3 hrs.	20	80	100

Course Outcomes **Total:60hrs**

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 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.	15
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-23B Digital Image Processing

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-23B	Theory	4	4	3 hrs.	20	80	100

Course Outcomes **Total:60hrs**

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- Neighbors and Connectivity of pixels in image, Applications of Image Processing: Medical imaging, Robot vision, Character recognition, Remote Sensing.	15

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	

DSC-23C 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-23C	Theory	4	4	3 hrs.	20	80	100

Course Outcomes **Total:60hrs**

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	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
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-23D 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-23D	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	15

	learning rule coefficient.	
II	**Architecture:** Counter propagation network architecture - functioning & characteristics of counter - Propagation network - Hopfield/Recurrent - 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.*	15
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.
3. W. T. Miller, R. S. Sutton, P. J. Webros, "Neural Networks for Control", MIT Press, 1996.
4. Herniter, Marc E., "Programming in MATLAB", Brooks/Cole-Thomson Learning, 2001.

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	