K. C. E. Society's
Moolji Jaitha College
An 'Autonomous College' Affiliated to
K.B.C. North Maharashtra University, Jalgaon.
NAAC Reaccredited Grade - A (CGPA : 3.15 - 3rd Cycle)
UGC honoured "College of Excellence" (2014-2019)
DST(FIST) Assisted College

KNOWLEDGE IS POWER
ESTD. 1945

के. सी. ई. सोसायटीचे
मूळजी जेठा महाविद्यालय
क.ब.चौ. उत्तर महाराष्ट्र विद्यापीठ, जळगाव संलग्नित
'स्वायत्त महाविद्यालय'
नॅकद्वारा पुनर्मानांकित श्रेणी – 'ए' (सी.जी.पी.ए. : ३.१५ – तिसरी फेरी)
विद्यापीठ अनुदान आयोगाद्वारा घोषित 'कॉलेज ऑफ एक्सलन्स' (२०१४-२०१९)
डी.एस.टी. (फीस्ट) अंतर्गत अर्थसहाय्य प्राप्त

Date :- 01/08/2023

NOTIFICATION

Sub :- CBCS Syllabi of M. Sc. in Comp. Scie (Sem. I & II)

Ref. :- Decision of the Academic Council at its meeting held on 26/07/2023.

The Syllabi of M. Sc. in Comp. Scie (First and Second Semesters) as per **NATIONAL EDUCATION POLICY - 2020** and approved by the Academic Council as referred above are hereby notified for implementation with effect from the academic year 2023-24.

Copy of the Syllabi Shall be downloaded from the College Website (www.kcesmjcollege.in)

Sd/-
Chairman,
Board of Studies

To :

1) The Head of the Dept., M. J. College, Jalgaon.
2) The office of the COE, M. J. College, Jalgaon.
3) The office of the Registrar, M. J. College, Jalgaon.

Near Samarth Colony, Jalgaon - 425 002. (Maharashtra, India) | Ph. : +91 257 - 2237363, 2234281 | e-mail : mjcollege@kces.in | Website : mjcollege.kces.in
समर्थ कॉलनी जवळ, जळगांव – ४२५ ००२. (महाराष्ट्र, भारत) । दूरध्वनी क्र. : +९१ २५७–२२३७३६३, २२३४२८१ । ई–मेलः mjcollege@kces.in । वेबसाईटः mjcollege.kces.in

Moolji Jaitha College, Jalgaon

An "Autonomous College"

Affiliated to

Kavayitri Bahinabai Chaudhari
North Maharashtra University, Jalgaon-425001

STRUCTURE AND SYLLABUS

F.Y. M.Sc. Computer Science

Under Choice Based Credit System (CBCS)
and
as per NEP-2020 Guidelines

[w.e.f. Academic Year: 2023-24]

Preface

This course is designed to provide one with a comprehensive understanding of the principles, theories, and practices that form the foundation of modern computer science. In today's fast-paced and technology-driven world, computer science plays a crucial role in almost every aspect of our lives. From advanced algorithms and artificial intelligence to data management and current computing trends, the field of computer science offers endless possibilities and opportunities for innovation.This program is tailored to equip students with the knowledge and skills needed to excel in the dynamic and ever-evolving field of computer science. Whether you are a recent graduate or a seasoned professional seeking to enhance student's expertise, this course will challenge and inspire a student to push the boundaries of what is possible.

Throughout this program, students will delve into a wide range of topics, including software development, computer architecture, database systems, machine learning, IoT, and much more. Students will have the opportunity to engage in hands-on projects, collaborate with peers, and learn from experienced faculty members who are leaders in their respective fields.Beyond the technical aspects, this program also emphasizes critical thinking, problem-solving, and effective communication skills. These are essential qualities that will enable students to navigate complex challenges and make meaningful contributions to the field of computer science. Master of Computer Science program will provide students with the necessary foundation and opportunities to excel in their chosen career path.

Programme Outcomes (PO) for M.Sc. Computer Science:

Upon successful completion of the M.Sc. program, student will be able to:

PO No.	PO
1	Understand the basic concepts and fundamental principles related to various science branches
2	Aquaint the skills in handling scientific instruments and performing in laboratory experiments
3	Relate various scientific phenomena and their relevancies in the day-to-day life.
4	Analyse experimental data critically and systematically to draw the objective conclusions.
5	Develop various skills such as communication, leadership, teamwork, social, research etc., which will help in expressing ideas and views clearly
6	Develop interdisciplinary approach for providing better solutions and sustainable developments.

Programme Specific Outcome (PSO) for M.Sc. Computer Science:

After completion of this course, students are expected to:

PO No.	PSO
1	Acqire a deep understanding of advanced concepts, theories and principles in various areas of computer science.
2	Attain specialized knowledge and skills in a specific area of computer science.
3	Develop advanced problem-solving skills by applying theoretical knowledge and practical techniques to address complex challenges.
4	Acquire advanced programming and software development skills, including proficiency in multiple programming languages.
5	Foster critical thinking abilities to analyze, evaluate anf assess computer science problems, theories and methodologies.
6	Foster a commitment to lifelong learning and professional development by staying updated with emerging techniques and industry practices.

Credit distribution structure for Three/ Four year Honors/ Honors with Research Degree Programme with Multiple Entry and Exit

Level	Sem	Major (Core) Subjects		Minor Subjects (MIN)	GE/ OE	VSC, SEC (VESC)	AEC, VEC, IKS	CC, FP, CEP, OJT/Int, RP	Cumulative Credits/Sem	Degree/ Cumulative Cr.
		Mandatory (DSC)	Elective (DSE)							
4.5	I	DSC-1 (2T) DSC-2 (2T) DSC-3 (2P)	—	MIN-1 (2T) MIN-2 (2P)	OE-1 (2T)	SEC-1 (2T) SEC-2 (1P)	AEC-1 (2T) (ENG) VEC-1 (2T) (ES) IKS (1T)	CC-1 (2)	22	UG Certificate 44
	II	DSC-4 (2T) DSC-5 (2T) (IKS) DSC-6 (2P)	...	MIN-3 (2T) MIN-4 (2P)	OE-2 (2T)	SEC-3 (2T) SEC-4 (1P)	AEC-2 (2T) (ENG) VEC-2 (2T) (CI) IKS (1T)	CC-2 (2)	22	
	Cum. Cr	12	...	8	4	6	4+4+2	4	44	
Exit option: Award of UG Certificate in Major with 44 credits and an additional 4 credits core NSQF course/ Internship OR Continue with Major and Minor.										
5.0	III	DSC-7 (2T) DSC-8 (2T) DSC-9 (2P) DSC-10 (2P)	...	MIN-5 (2T) MIN-6 (2P)	OE-3 (2T) OE-4 (2P)		AEC-3 (2T) (MIL)	CC-3 (2) CEP (2)	22	UG Diploma 88
	IV	DSC-11 (2T) DSC-12 (2T) DSC-13 (2P) DSC-14 (2P)	...	MIN-7 (2T) MIN-8 (2P)	OE- 5 (2T) OE-6 (2P)		AEC-4 (2T) (MIL)	CC-4 (2) FP (2)	22	
	Cum. Cr	28	...	16	10	6	8+4+2	8+2+2	88	
Exit option: Award of UG Diploma in Major and Minor with 88 credits and an additional 4 credits core NSQF course/ Internship OR Continue with Major and Minor.										
5.5	V	DSC-15 (2T) DSC-16 (2T) DSC-17 (2T) DSC-18 (2P) DSC-19 (2P)	DSE-1 (2T) A/B DSE-2 (2P) A/B	MIN-9 (2T/P)	...	VSC-1 (2T) VSC-2 (2P)	...	OJT/Int(2)	22	UG Degree 132
	VI	DSC-20 (2T) DSC-21 (2T) DSC-22 (2T) DSC-23 (2P) DSC-24 (2P)	DSE-3 (2T) A/B DSE-4 (2P) A/B	MIN-10(2T/P)	—	VSC-3 (2T) VSC-4 (2P)	...	OJT/Int(2)	22	
	Cum. Cr.	48	08	20	10	8+6	8+4+2	8+2+2+4	132	
Exit option: Award of UG Degree in Major with 132 credits OR Continue with Major and Minor										
6.0	VII	DSC-25 (4T) DSC-26 (4T) DSC-28 (4T) DSC-27 (2P)	DSE-5 (2T) A/B DSE-6(2P) A/B	RM (4T)	—	...	...	—	22	UG Honors Degree 176
	VIII	DSC-29 (4T) DSC-30 (4T) DSC-32 (4T) DSC-31 (2P)	DSE-7 (2T) A/B DSE-8(2P) A/B	—	—	...	...	OJT/Int (4)	22	
	Cum. Cr.	76	16	20+4	10	8+6	8+4+2	8+2+2+8	176	
Four Year UG Honors Degree in Major and Minor with 176 credits										
6.0	VII	DSC-25 (4T) DSC-26 (4T) DSC-27 (2P)	DSE-5 (2T) A/B DSE-6 (2P) A/B	RM (4T)	—	...	...	RP (4)	22	UG Honors with Research Degree 176
	VIII	DSC-29 (4T) DSC-30 (4T) DSC-31 (2P)	DSE-7 (2T) A/B DSE-8 (2P) A/B	—	—	...	...	RP (8)	22	
	Cum. Cr.	68	16	20+4	10	8+6	8+4+2	8+2+2+8+12	176	
Four Year UG Honours with Research Degree in Major and Minor with 176 credits										

Sem- Semester, **DSC**- Department Specific Course, **DSE**- Department Specific Elective, **T**- Theory, **P**- Practical, CC-Cocurricular **RM**- Research Methodology, **OJT**- On Job Training, **FP**- Field Project, **Int**- Internship, **RP**- Research Project,

Multiple Entry and Multiple Exit options:

The multiple entry and exit options with the award of UG certificate/ UG diploma/ or three-year degree depending upon the number of credits secured;

Levels	Qualification Title	Credit Requirements		Semester	Year
		Minimum	Maximum		
4.5	UG Certificate	40	44	2	1
5.0	UG Diploma	80	88	4	2
5.5	Three Year Bachelor's Degree	120	132	6	3
6.0	Bachelor's Degree- Honours **Or** Bachelor's Degree- Honours with Research	160	176	8	4

F. Y. M. Sc. Computer Science Structure and Syllabus

Semester	Course Module	Credit	Hours/ week	TH/ PR	Code	Title
I	DSC	4	4	TH	CS-DSC-511	Artificial Intelligence
	DSC	4	4	TH	CS-DSC-512	Automata Theory and Computability
	DSC	4	4	TH	CS-DSC-513	Software Engineering
	DSE	2	2	TH	CS-DSE-514A	Advanced C++ Programming
	DSE	2	2	TH	CS-DSE-514B	Digital Image Processing
	DSC	2	4	PR	CS-DSC-515	Practical course based on Artificial Intelligence
	DSE	**2**	**4**	**PR**	CS-DSE-516A	Practical course based on Advanced C++ Programming
	DSE	**2**	**4**	**PR**	CS-DSE-516B	Practical course based on Digital Image Processing
	RM	**4**	**4**	**TH**	CS-RM -517	Research Methodology for Computer Science
II	DSC	4	4	TH	CS-DSC-521	Design and Analysis of Algorithms
	DSC	4	4	TH	CS-DSC-522	Advanced Network Programming
	DSC	4	**4**	TH	CS-DSC-523	Information Security
	DSE	2	2	TH	CS-DSE-524A	Advanced Java Programming
	DSE	2	**2**	TH	CS-DSE-524B	PowerBi
	DSC	2	4	**PR**	CS-DSC-525	Practical course based on Design and Analysis of Algorithms
	DSE	2	4	**PR**	CS-DSE-526A	Practical course based on Advanced Java Programming
	DSE	2	**4**	**PR**	CS-DSE-526B	Practical course based on PowerBi
	OJT	4	**8**	**PR/OJT**	CS-OJT-527	On Job Training/Internship

DSC	**:**	Department-Specific Core course
DSE	**:**	Department-Specific elective
TH	**:**	Theory
PR	**:**	Practical

Exam Pattern

Theory / Practical	Credit	Internal	External
Theory	**4**	**40**	**60**
Theory	**2**	**20**	**30**
Practical	**4**	**40**	**60**

External Theory Examination (60 marks)

- External examination will be of 3 hours duration for each theory course. There shall be 5 questions each carrying equal marks (12 marks each) while the tentative pattern of question papers shall be as follows;
- Q1 attempt any 4 out of 5 sub-questions; each 3 marks.
- Q2, Q3, Q4 attempt any 2 out of 3 sub-questions; each 6 marks.
- Q5 attempt any 3 out of 4 sub-questions, each 4 marks

External Practical Examination (60 marks):

- Practical examination shall be conducted by the respective department at the end of the semester. Practical examination will be of minimum 3 hours duration and shall be conducted as per schedule. There shall be 05 marks for journal, 10 marks for *viva-voce*. Certified journal is compulsory to appear for practical examination.

Internal Theory/ Practical Examination (40 marks):

- Internal theory assessment of the student by respective teacher will be comprehensive and continuous, based on written test/ assignment. The written test may comprise of both objective and subjective type questions.
- Internal practical examination should be conducted by respective department as per schedule given. For internal practical examination student should perform at least one major and one minor experiment and should have completed journal.

SEMESTER-I

F.Y. M.Sc
SEMESTER-I
CS-DSC-511 : Artificial Intelligence

Total Hours: 60 **Credits: 4**

Course objectives	To understand and learn: • concepts of Artificial Intelligence. • methods of solving problems using Artificial Intelligence • various peculiar search strategies for AI. • supervised, unsupervised and reinforcement learning and to study its applicability	
Course outcomes	After successful completion of this course, students are expected to: • Identify appropriate AI methods to solve a given problem. • Design smart system using different search or heuristic approaches. • Apply the suitable algorithms to solve AI problems. • Focus on exploring supervised, unsupervised and reinforcement learning and apply them to a range of AI problems.	
Unit	**Content**	**Hours**
Unit I	**Introduction and Problems, Problem Spaces, and Search and Knowledge Representation** ○ What is Machine Intelligence? ○ The AI Problems, ○ What is an AI Technique, ○ Criteria for Success, ○ AI Task domains. ○ Defining the Problem as a State Space Search, ○ Production systems, Problem ○ Characteristics ○ Production System Characteristics, ○ Issues in the Design of Search Programs ○ Uninformed Search Techniques: DFS and BFS ○ Heuristic Search Techniques: Generate-and- Test, Hill Climbing, Best-First Search, A* Search, AO* Search ○ Knowledge Representation Issues, ○ Representations and Mappings ○ Approaches to Knowledge Representation ○ Issues in Knowledge Representation ○ The Frame Problem.	**20**
Unit II	**Predicate Logic, Weak Slot and Strong Slot Filler Structures and Learning** ○ Representing Instance and Isa Relationships, ○ Computable Functions and Predicates, ○ Resolution, Natural Deduction. ○ Semantic Nets, ○ Frames. ○ Conceptual Dependency ○ Scripts. ○ Learning- What is learning?, Rote Learning, Learning by taking advice Learning in problem olving, Learning from examples, Explanation based learning	**20**
Unit III	**Planning & Understanding, Neural networks** ○ Introduction, An example Domain – the block world,	**10**

	○ Components of the planning system , ○ What is understanding?, ○ What makes understanding hard, ○ Understanding as constraints satisfaction ○ Machine Learning Using Neural Network: Adaptive Networks, Feed forward Networks, ○ Supervised Learning Neural Networks, ○ Radial Basis Function Networks, Reinforcement Learning, ○ Unsupervised Learning.	
Unit IV	**Fuzzy logic and Genetic algorithms** ○ Fuzzy Sets, Operations on Fuzzy Sets, ○ Fuzzy Relations, Membership Functions, ○ Fuzzy Rules and Fuzzy Reasoning, Fuzzy Inference Systems, Fuzzy Expert Systems , ○ Fuzzy Decision Making. ○ Introduction to Genetic Algorithms (GA) ,Applications of GA in Machine Learning , ○ Significance of the Genetic Operators	**10**
Study Resources	• Rich E., Knight K., (1991) "Artificial Intelligence", 2nd Ed., Tata McGrawHill • Russell S., Norvig P., (2010) "Artificial Intelligence – A modern approach", Prentice Hall.	

F.Y. M.Sc
SEMESTER-I
CS-DSC-512 : Automata Theory and Computability

Total Hours: 60 **Credits: 4**

Course objectives	To understand and learn: • To aware students about formal languages and automata theory • To understand the conversion from regular expressions, regular set to FA and vice versa • To understand phase structure grammar and its equivalent turing machine and pushdown automata • To solve problem related to decidability and computability	
Course outcomes	After successful completion of this course, students are expected to: • apply the theoretical knowledge of Mathematics and Computational Sciences to model and solve real time problems. • convert regular expressions and regular set to Finite Automata and vive versa. • Apply phase structure grammar and its equivalent turing machine. • explore the concept of decidability and computability for various problems.	
Unit	**Content**	**Hours**
Unit I	**Finite Automata and Regular Languages** ○ States and Automata, Finite Automata as Language Acceptors, ○ Deterministic Finite Automata ○ Non deterministic Finite Automata, Properties of Finite Automata : Equivalence of finite Automata, transitions, ○ Moore and Mealy machine models, ○ Regular expressions : Definition and examples, Regular expressions and finite automata, Regular expressions from DFA.	**10**
Unit II	**Regular Sets and Context Free Grammar** ○ Pumping lemma for regular sets, application of pumping lemma, closure properties of regular sets ○ Context free grammar, Derivation tree: Leftmost, rightmost, ambiguous grammar ○ Simplification of context free grammar: Construction of reduced grammar, elimination ○ Null production and elimination of unit production. ○ Normal forms: Chomsky Normal Form, ○ Griebach Normal Form.	**16**
Unit III	**Pushdown Automata and Turing Machine** ○ Acceptance by empty store and final state, equivalence between pushdown automata ○ Context free grammar, Closure properties of CFL, Deterministic PDA. ○ Techniques for TM construction : Generalized and restricted versions equivalent to the basic model,Godel numbering, ○ universal TM, recursive enumerable sets and recursive sets, ○ computable functions, time-space complexity measures, context sensitive	**16**

	languages o linear bounded automata(LBA), multitapeturing machine	
Unit IV	**Decidability and Computability** o Post correspondence problem, decidability of membership, emptiness and equivalence problems of languages. o Computability o Primitive Recursive functions : Initial function, Primitive recursive functions over N, o Primitive recursive functions{a,b}. Recursive functions	**18**
Study Resources	• Mishra K., Chandrasekaran N., (2008). "Theory of Computer Science : Automata Languages and Computation", Prentice Hall of India. • Sane S.,(2007). "Theory of Computer Science", 2nd Ed., Technical Publications. • Hopcraft J., Motwani R., Ullman J.,(2009). "Introduction to Automata Theory, Languages & Computations", 3rd Ed. Pearson publication.	

F.Y. M.Sc
SEMESTER-I
CS-DSC-513 : Software Engineering

Total Hours: 60 **Credits: 4**

Course objectives	To understand and learn: • nature of software development and software life cycle process models. • concepts and principles of software design and user-centric approach and principles of effective user interfaces • basics of testing and understanding concept of software quality assurance and software configuration management process. • project scheduling concept and risk management associated to various type of projects.	
Course outcomes	After successful completion of this course, students are expected to: • Understand and demonstrate basic knowledge in software engineering • Define various software application domains and remember different process model used in software development. • Convert the requirements model into the design model and demonstrate use of software and user interface design principles • Distinguish among SCM and SQA and can classify different testing strategies and tactics and compare them.	
Unit	**Content**	**Hours**
Unit I	**Introduction to Software Engineering and Software Process Models** o The nature of software o Defining software o Software Application Domain o Legacy Software o Software Engineering o Software Process o Incremental Process Model o Concurrent Process Model o Specialized Process Model	**16**
Unit II	**Requirement Specifications and Design Concepts** o Requirements Engineering, Establishing the ground work, Eliciting Requirements o Developing Use cases, Building the requirements model, validating requirements o Design Process, Concepts, Design Models o Architectural Design- Software architecture, o User Interface Design – User Interface Analysis and Design o Pattern based Design – Design Pattern	**20**
Unit III	**Testing** o Levels of testing – Functional, Structural, Test Plan, Test case specification o Types of testing – Unit testing, Integration Testing, Function Testing, System testing, Performance testing, Accepting testing.	**10**

Unit IV	**Quality Management and Software Configuration Management** o What is quality? Software quality- Gravin's quality dimension, McCall's quality factor, ISO 9126 quality factors o Targeted quality factor o Review Technique- Formal Technical Review, Software Configuration Items o SCM Repository o SCM Process	**14**
Study Resources	• Pressman R.S. (2010), "Software Engineering: A Practitioner's Approach",7th Ed. McGraw-Hill International Ed.. • Jalote P. (2010), "Software Engineering: A Precise Approach", Wiley India Pvt. Limited • Aggarwal K. and Singh Y.,(2007), "Software Engineering", 3rd Ed., New Age International Publishers	

F.Y. M.Sc
SEMESTER-I
CS-DSE-514A : Advanced C++ Programming

Total Hours: 30 **Credits: 2**

Course objectives	To understand and learn: • basic concepts of object oriented programming. • advanced concept like algorithms, containers and generic algorithms. • advance concepts like STL • basic patterns using C++.	
Course outcomes	After successful completion of this course, students are expected to: • develop programs with advanced concepts. • develop efficient programs with the help of container classes and generic algorithms. • implement STL programs. • implement patterns using C++.	
Unit	**Content**	**Hours**
Unit I	**Applications of C++ Concepts and Runtime Type Information** o Object Validation, Smart Pointers, o Reference Counting, Generic Smart Pointers o Collection Classes in Object-Based Hierarchies, o Independent Class Hierarchies in C++ o Duplicate Sub objects Virtual Base Classes. o Runtime Type Information (RTTI) Mechanism: type_info Class and typeid Operator, Type o Safe Pointer Conversion, New C++ Cast Syntax	**5**
Unit II	**An Overview of Templates and STL:** o Templates, Template functions, Specializing a template function, Overloading template functions, o Disambiguation under specialization, Template classes, o An array template class o Instantiating a template class object, Rules for templates o Non member function with a template argument o Friends of template classes, Templates with multiple type parameters, o Non type parameters for template classes, Comments regarding templates o Introduction to Standard Template Library: Why STL, Sequential, Container Adapter, o Associative Container, o Iterator, Algorithms.	**8**
Unit III	**STL Iterators and Containers** o Introductio:,Input iterators, Output iterators, Forward iterators, Backward iterators. o Sequential Container:-vector, deque list, o Container Adapter: Stack, Queue, Proiority Queue o Associative Containers: Set, Multiset, Map o Generic Algorithms: Non modifying algorithms, mutating algorithms, soring algorithms	**8**

Unit IV	**Basic Design Patterns in C++:** ○ Creational Patterns ○ Structural Patterns ○ Behavioral Patterns ○ Factory and Factory method ○ Abstract Factory ○ Prototype	**9**
Study Resources	• Stevens A., (2003) "C++ Programming", 7th Ed.,Wiley India Pvt Ltd. • Deitel P., Deitel H., (2010). "C++ How to Program" , 7th Ed.,Prentice Hall. • Murray W., Pappas C., (2001). "Data Structures with STL" ,1st Ed., Prentice Hall PTR. • Glass G., Schuchert B., (1996). "The STL Primer", 1st Ed.,Prentice Hall. • Stroustrup B., (1997)."The C++ Programming Language", 3rd Ed.,Addison Wesley Longman. • Nesteruk D., (2018)."Design Patterns in Modern C++: Reusable Approaches for Object-Oriented Software Design", APress	

F.Y. M.Sc
SEMESTER-I
CS-DSE-514B : Digital Image Processing

Total Hours: 30 **Credits: 2**

Course objectives	To understand and learn: • To equip students with the fundamental knowledge and basic technical competence in the field of Computer Graphics and Digital Image Processing. • To provide an understanding of how to scan convert the basic geometrical primitives, basic principles of 2 and 3- dimensional computer graphics. • To be able to discuss the application of computer graphics concepts in the development of information visualization, and business applications • Give an in-depth knowledge about the basic theory and algorithms related to Digital Image Processing.	
Course outcomes	After successful completion of this course, students are expected to: • develope scientific and strategic approach to solve complex problems Computer in the domain of Computer Graphics and Digital Image Processing. • demonstrate various algorithms for scan conversion and filling of basic primitives objects and their comparative analysis and applied 2-D and 3-D geometric transformations, viewing and clipping on graphical objects. • built the mathematical foundations for digital image representation, image acquisition, image transformation, image enhancement and restoration. • develope a theoretical foundation of fundamental concepts of digital image processing.	
Unit	**Content**	**Hours**
Unit I	**Introduction** o Introduction to DIP o Application of Digital Image Processing o Fundamental Steps in Digital Image Processing o Components of an Image Processing System o Image file Formats (GIF,BMP,TIFF,JPEG).	**7**
Unit II	**Image Processing Fundamental** o Elements of Visual Perception o Image Sensing and Acquisition o Image Sampling And Quantization. o Some Basic Relationships between Pixel, o array versus Matrix operation, o Linear versus Nonlinear Operations.	**7**
Unit III	**Image Enhancement** o Background. o Some Basic Intensity Level Transformation functions o Histogram Processing. o Fundamental of Spatial Filtering.	**8**

	○ Smoothing Spatial Filters. ○ Sharpening Spatial Filters.Combining Spatial Enhancement Methods	
Unit IV	**Filtering in Frequency Domain** ○ Introduction to the Fourier Transform and the Frequency Domain. ○ Smoothing Frequency- Domain Filters. ○ Sharpening Frequency Domain Filters. ○ Homomorphic Filtering.	**8**
Study Resources	• Gonzalez R.,Woods R., (2002).“Digital Image Processing”, 2nd Ed., Prentice Hall. • Jayaraman S , (2009).”Digital Image Processing”, 1st Ed., TMH(McGraw Hill Education) publication. • Jain A.,(1995).“Fundamentals of Image processing”, 1st Ed., , Prentice Hall of India Publication. • Sridhar S., (2011).“Digital Image Processing”, 1st Ed,OxfordUniversity Press.	

F.Y. M.Sc
SEMESTER-I
CS-DSC-515 : Practical course based on Artificial Intelligence

Total Hours: 60 **Credits: 2**

Course objectives	To understand and learn: • concepts of Artificial Intelligence. • the methods of solving problems using Artificial Intelligence • various peculiar search strategies for AI. • supervised, unsupervised and reinforcement learning and to study its applicability	
Course Outcomes	After successful completion of this course, students are expected to: • identify appropriate AI methods to solve a given problem. • design smart system using different search or heuristic approaches. • apply the suitable algorithms to solve AI problems. • focus on exploring supervised, unsupervised and reinforcement learning and apply them to a range of AI problems.	
Sr. No.	**Content**	**Hours**
1	Implementation of uniform search technique: Depth First Search	**4**
2	Implementation of uniform search technique: Breadth First Search	**4**
3	Implementation of informed search technique: Best First Search.	**4**
4	Implementation of informed search technique: Branch and Bound Search.	**4**
5	Implementation of informed search technique: A* search	**4**
6	Implementation of informed search technique: Hill climbing search	**4**
7	Implementation of informed search technique: AO* search	**4**
8	Implementation of water jug problem	**4**
7	Implementation of Missionaries and Cannibals Problem	**4**
8	Write a Program to find solution to Tic-Tac-Toe Problem	**4**
9	Write a Program to find solution to Tower of Honai Problem	**4**
10	Write a Program to find solution to 4 queen Problem	**4**
11	Write a Program to find solution to 8 queen Problem	**4**
12	Case Study on Baysian Network	**4**

13	Case Study on Reinforcement Learning	**4**
14	Case Study on Supervised Learning	**4**
15	Case Study on Unsupervised Learning	**4**
Study Resources	• Rich E., Knight K., (1991) "Artificial Intelligence", 2nd Ed., Tata McGrawHill • Russell S., Norvig P., (2010) "Artificial Intelligence – A modern approach", Prentice Hall.	

F.Y. M.Sc
SEMESTER-I
CS-DSE-516A : Practical course based on Advanced C++ Programming

Total Hours: 60 **Credits: 2**

Course objectives	To understand and learn: • basic concepts of object oriented programming. • generic programming concept while problem solving • to develop applications using STL. • to design the patterns using C++ programming	
Course Outcomes	After successful completion of this course, students are expected to: • Develop efficient object oriented programs. • Apply generic concept in problem solving. • Design the different patterns according to the need using advanced C++ concepts. • Handle runtime exceptions.	
Sr. No.	**Content**	**Hours**
1	Practical to demonstrate use of function templates	**4**
2	Practical to demonstrate use class templates	**4**
3	Practical to demonstrate use of containers like vector, list, forward_list, queue, priority_queue,	**4**
4	Practical to demonstrate use of containers : forward_list	**4**
5	Practical to demonstrate use of containers :queue	**4**
6	Practical to demonstrate use of containers : priority_queue	**4**
7	Practical to demonstrate use of containers like stack, set, multiset, map, multimap, unordered_set etc.	**4**
8	Practical to demonstrate use o iterator operation: std :: advance : Advance iterator , std :: distance, std :: begin, std :: end, std :: prev , std :: next :std :: next vs std :: advance	**4**
9	Practical to demonstrate use of adaptors : stack,queue,priority_queue etc.	**4**
10	Practical to demonstrate use of member functions associated with allocators such as address, construct, destroy, max_size, allocate,deallocate	**4**
11	Practical to demonstrate use of specialized containers and associative containers.	**4**
12	Practical to demonstrate generic algorithms for sorting.	**4**
13	Practical to demonstrate generic algorithms for searching.	**4**
14	C++ program to design pattern using builder pattern	**4**
15	C++ program to design pattern using factory pattern	**4**

Study Resources	• Stevens A., (2003) "C++ Programming", 7th Ed.,Wiley India Pvt Ltd. • Deitel P., Deitel H., (2010). "C++ How to Program" , 7th Ed.,Prentice Hall. • Murray W., Pappas C., (2001). "Data Structures with STL" ,1st Ed., Prentice Hall PTR. • Glass G., Schuchert B., (1996). "The STL Primer", 1st Ed.,Prentice Hall. • Stroustrup B., (1997)."The C++ Programming Language", 3rd Ed.,Addison Wesley Longman. • Nesteruk D., (2018)."Design Patterns in Modern C++: Reusable Approaches for Object-Oriented Software Design", APress

F.Y. M.Sc
SEMESTER-I
CS-DSE-516B: Practical course based on Digital Image Processing

Total Hours: 60 **Credits: 2**

Course objectives	To understand and learn: • To aquent basic knowledge of Digital image processing • To introduce MATLAB to implement the complex algorithms of Digital Image Processing. • Provide hands-on experience to process digital images and expose students to MATLAB Image Processing Toolbox for Digital Image Enhancement, • Provide filtering, noise removal in image	
Course Outcomes	After successful completion of this course, students are expected to: • expose students to MATLAB and Image Processing Toolbox. • use various tools in MATLAB to implemented image transformation, image enhancement in spatial and frequency domain. • develope the programs on various digital image processing techniques. • Develop program for image filtering and noise removal	
Sr. No.	**Content**	**Hours**
1	Introduction to Image Processing Toolbox	**4**
2	Write a program to read an 8 bit image and then apply image enhancement techniques: Brightness improvement and Brightness reduction	**4**
3	Write a program to apply image enhancement techniques: Thresholding	**4**
4	Write a program to apply image enhancement techniques: Negative of an image and Log transformation	**4**
5	Write a program to apply image enhancement techniques: Power Law transformation.	**4**
6	Write a program to Plot image histogram then do histogram equalization.	**4**
7	Write a program to Read an image and apply Gray level slicing (intensity level slicing) in to read cameraman image.	**4**
8	Write a program to Read an 8 bit image and to see the effect of each bit on the image.	**4**
9	Write a program to Read an image and to extract 8 different planes i.e. ‘bit plane slicing.”	**4**
10	Write a program to Implement various Smoothing spatial filter.	**4**
11	Write a program to Read an image and apply Gaussian 3x3 mask for burring	**4**
12	Write a program to High pass filter mask with different masks	**4**
13	Write a program to implement various low pass filters and high pass filter in frequency domain.	**4**
14	Write a program to Implement and study the effect of Different Mask (Sobel, Prewitt and Roberts)	**4**
15	Write a program to Implement various noise models and their Histogram	**4**

Study Resources	• Gonzalez R.,Woods R., (2002).“Digital Image Processing”, 2nd Ed., Prentice Hall. • Jayaraman S , (2009).”Digital Image Processing”, 1st Ed., TMH(McGraw Hill Education) publication. • Jain A.,(1995).“Fundamentals of Image processing”, 1st Ed., , Prentice Hall of India Publication. • Sridhar S., (2011).“Digital Image Processing”, 1st Ed,OxfordUniversity Press.	

F.Y. M.Sc
SEMESTER-I
CS-RM-517 : Research Methodology for Computer Science

Total Hours: 60 **Credits: 4**

Course objectives	To understand and learn: • Students should be able to identify the overall process of designing a research study from its inception to its report • Students should know the primary characteristics of quantitative research and qualitative research. • Students should be familiar with conducting a literature review for a scholarly educational study • Students should know how to conduct a statistical test of a hypothesis	
Course outcomes	After successful completion of this course, students are expected to: • take up and implement a research project/ study • enable them to collect the data, edit it properly and analyse it accordingly. • develop skills in qualitative and quantitative data analysis and presentation. • demonstrate the ability to choose methods appropriate to research objectives.	
Unit	**Content**	**Hours**
Unit I	**Introduction to Research Methodology** o Meaning, Objectives o Types of research o Approaches o Importance o Research Methodology o Research Ethics-Guidelines, Research misconducts o Ethical Issues in Research o Scientific Research, o Process o Criteria for Good Research, o Problems Encountered o Defining Research Problem o Testing of hypothesis: Concepts for hypothesis testing, type-I and type-II error, level of significance	**15**
Unit II	**Research and Sample Design** o Six P of Research o Steps Criteria for Sampling Procedure o Characteristics of Good Sample Design, o Different Types of Sample Design- (a) Probability Sampling Like Simple Random, System Random, Systematic Random, Stratified, Cluster.(b) Non Probability Sampling Like Quota, Judgmental, Convenience o Data Collection Method- Primary Data- Observation Method, Personal Interview, Telephonic Interview, Mail Survey, Questionnaire Design	**15**

Unit III	**Data Preparation and Statistical Analysis** o Quantitative and Qualitative Data o Data Preparation Process: Classification, Tabulation, Graphical Representation, Data Cleaning. o Measures of Central Tendency : Mean, Mode, Median o Measures of Dispersion: Range , Mean deviation, Standard Deviation o Measures of Skewness and Kurtosis o Chi-Square Test and ANOVA	**15**
Unit IV	**Report Writing and Interpretation** o Meaning, Techniques and Precautions in Interpretation o Significance of Report writing o Steps of Report Writing, types of reports, formats of research report o Types of Report o Formats of Publication in Research Journals.	**15**
Study Resources	• Kothari C., Garg G. (2019). "Research Methodology-Methods and Techniques",4th Ed., New Age Publications. • Kishor S., Vaidya B.,(2012). "Operation Research", Das Ganu Prakashan, Nagpur • Bhattacharyya D., (2003). "Research Methodology", 1st Ed. EBP, New Delhi • Sancheti and Kapoor,(2010). "Business Statics", Sultan Chand and Sons, New Delhi	

SEMESTER-II

F.Y. M.Sc
SEMESTER-II
CS-DSC-521 : Design and Analysis of Algorithms

Total Hours: 60 **Credits: 4**

Course objectives	To understand and learn: • Basic concepts of algorithms and analyze the performance of algorithms. • Algorithm design techniques for developing algorithms. • Searching and traversal algorithms for graphs. • Nondeterministic algorithms and NP class of problem	
Course outcomes	Analyze the asymptotic performance of algorithms. • Write rigorous correctness proofs for algorithms. • Design and analyze divide-and-conquer based algorithms. • Devise and Synthesize greedy and dynamic-programming based algorithms. • Employ graphs to model problems solvable using traversal techniques.	
Unit	**Content**	**Hours**
Unit I	**Introduction** o What Is An Algorithm?, Algorithm Specification, Pseudocode Conventions, o Recursive Algorithms o Complexity and Asymptotic Notation, o Tree And Graph Representations, Binary Trees Basics, Heaps And Heap Sort	**14**
Unit II	**Divide and Conquer** o Control Abstraction o Binary Search o Finding Maximum and Minimum o Merge Sort o Quick Sort o Strassen's Matrix Multiplication.	**16**
Unit III	**The Greedy Method and Dynamic Programming** • **Greedy Method** o Control abstraction o Single-Source Shortest Paths o Knapsack Problem o Huffman Code o Minimum-CSt Spanning Trees (Prim's & Kruskal's Algorithm) • **Dynamic Programming** o Control abstraction o All-Pair Shortest Path o Matrix Chain Multiplication o Longest Common Sub Sequence o 0/1knapsack, fractional knapsack	**20**

	○ Longest Common Subsequence ○ Breadth First Search and Traversal ○ Depth First Search And Traversal	
Unit IV	**Backtracking** ○ Control Abstraction ○ Constrains ○ 8-Queens Problem ○ Graph Coloring ○ Hamiltonian cycle	**10**
Study Resources	• Horowitz E., Sahni S. "Fundamentals of computer Algorithms" Galgotia publications. • Horowitz E., Sahni S. and Rajshekaran S,Computer Algorithms, Computer Science Press. • Dasgupta S., Papadimitriou C., and Vazirani U.(2006), Algorithms. McGraw-Hill publications. • Cormen, Leiserson and Rivest, (2009). Introduction to Algorithms, 3rd Ed. Prentice Hall of India.	

F.Y. M.Sc
SEMESTER-II
CS-DSC-522 : Advanced Network Programming

Total Hours: 60 **Credits: 4**

Course objectives	To understand and learn: • scope and working of Network Programming • Network Programming covering TCP, and UDP connections • Socket programming to design client- server environment • about mobile networking	
Course outcomes	After successful completion of this course, students are expected to: • Understand advanced knowledge of programming for network communications • Learn detailed knowledge of the TCP/UDP Sockets • Learn use of various solutions to perform inter-process communications • Apply knowledge of Unix/Linux operating systems to build robust client and server software for this environment	
Unit	**Content**	**Hours**
Unit I	**Network fundamentals** o Project model IEEE 802, Network topologies Network infrastructure, o Network Protocols UDP, TCP, o Introduction to TCP/IP o Architecture of the TCP/IP model.	**5**
Unit II	**Client server Programming and Application** o The client server model and software design, o The socket interface o concurrent processing in client- server software, o program interface to protocol algorithms & issues in client Software design, example client software o algorithms & issues in server software design o Iterative connectionless server, iterative connection oriented server, single process Concurrent server o concurrent connection oriented server, o multiprotocol server , o multi-service server o concurrency in client external data representation o remote procedure call concept, o RPCgen concept.	**20**
Unit III	**Network Interface Layer** o Overview of network interface layer o media access control standards, o mapping the Physical address to the IP address. o Internet Layer: Purpose of the internet layer	**20**

	○ classes of lpv4 addresses, ○ basics of routing, ○ IP datagram ○ ICMP, IGMP ○ Transport Layer Types of data transfer connection-less data transfer, connection-oriented data transfer	
Unit IV	**Mobile Ad-Hoc Network** ○ Overview of Wireless Ad-Hoc Network- ○ MANET and WSN, ○ Routing in Ad-Hoc Network, ○ Routing Protocols for Ad-Hoc Wireless Network (Proactive, Reactive and Hybrid) ○ Clustering Protocols	**15**
Study Resources	• Corner D., Stevens D. (1994). "Intranetworking with TCP/IP volume III Client Server Programming and Applications", 2nd Ed., Prentice Hall of India. • Corner D., Stevens D. (2015). "Internetworking with TCP/IP volume I, Principles protocols & Architecture", 3rd Ed.,PHI. • Corner D., Stevens D.(2003)."Internetworking with TCP/IP volume II Design Implementation and internals", 3rd Ed., Prentice Hall India Learning Private Limited. • Basagni S., Conti M., Giordano S., Stojmenović I.(2004). "Mobile Ad-Hoc Network", Willy Publication.	

F.Y. M.Sc
SEMESTER-II
CS-DSC-523 : Information Security

Total Hours: 60 **Credits: 4**

Course objectives	To understand and learn: • basics of information security, in management aspect and technical aspect. • various types of security incidents and attacks, and learn methods to prevent, detect and react incidents and attacks. • basics of application of cryptography which are one of the key technology to implement security functions • mechanism to protect confidentiality and completeness of data.	
Course outcomes	After successful completion of this course, students are expected to: • Learn various Information security threat and controls for it. • Explain information security incident response. • Understand usage of Common Key cryptography and Public Key Cryptography. • Learn and understand mechanism to protect confidentiality and completeness of data.	
Unit	**Content**	**Hours**
Unit I	**Introduction** Security, Attacks, Computer Criminals, Security Services, Security Mechanisms.	**10**
Unit II	**Information Security** • **Cryptography** o Substitution ciphers, Transpositions Cipher, Confusion, diffusion, o Symmetric, Asymmetric Encryption. DES Modes of DES, Uses of o Encryption, Hash function, key exchange, Digital Signatures, Digital o Certificates. • **Program Security** o Secure programs, Non malicious Program errors, Malicious codes virus, o Trap doors, Salami attacks, Covert channels, Control against program • **Threats Protection in OS** o Memory and Address Protection, Access control, File Protection, User o Authentication.	**26**
Unit III	**Database and Network Security** • **Database Security** o Requirements, Reliability, Integrity, Sensitive data, Inference, Multilevel Security. • **Security in Networks** o Threats in Networks, Security Controls, firewalls, Intrusion detection systems, Secure e-mails	**14**
Unit IV	**Administrating Security** o Security Planning, Risk Analysis, Organisational Security Policy,	**10**

	○ Physical Security. Ethical issues in Security: Protecting Programs and ○ data. Information and law.	
Study Resources	• Pfleeger C., Pfleeger S. (2006). Security in Computing, Prentice Hall of India. • Stallings W. (2010). Network Security Essentials: Applications and Standards, 4th Ed.	

F.Y. M.Sc
SEMESTER-II
CS-DSE-524A : Advanced Java Programming

Total Hours: 30 **Credits: 2**

Course objectives	To understand and learn: • fundamentals of Advanced Java rogramming language and its constructs. • fundamentals of collection classes in Java. • principles of JDBC. • concept of java servlet and JSP.	
Course outcomes	After successful completion of this course, students are expected to: • understand concept of object-oriented programming concept using Java. • design and implement the servlet programming. • understand how to use concept of JDBC in their application. • understand concept Java server Pages.	
Unit	**Content**	**Hours**
Unit I	**Introduction to Advanced JAVA** ○ Collections: Collection Framework ○ Array List class ○ Stack class ○ LinkedList class ○ List Iterator interface ○ HashSet class ○ LinkedHashSet class ○ TreeSet class ○ HashMap, LinkedHashMap ○ TreeMap	**7**
Unit II	**Database Programming** ○ The design of JDBC, jdbc configuration ○ Types of drivers, Executing sql statements ○ query execution ○ Scrollable and updatable result sets ○ Metadata - DatabaseMetadata, ResultSetMetadata ○ Transactions - commit(), rollback(), SavePoint.	**8**
Unit III	**Servlet** ○ Introduction to Servlet and Hierarchy of Servlet ○ Life cycle of Servlet ○ Tomcat- Introduction and Configuration ○ Handling get and post request (HTTP) ○ Handling a data from HTML to Servlet ○ Retrieving a data from database to Servlet	**7**

	○ Session tracking - User Authorization, URL Rewriting, Hidden form fields ○ Cookies, HttpSession.	
Unit IV	**Java Server Pages** ○ Life cycle of JSP ○ Implicit Objects ○ Scripting elements - Declarations, Expressions, Scriptlets, Comments ○ Simple JSP program ○ JSP Directives - Page directive, include directive ○ Mixing Scriptlets and HTML ○ Example of forwarding contents from database to servlet ○ servlet to JSP and displaying it using JSP scriptlet tag ○ User Defined Functions in JSP.	**8**
Study Resources	• Schildt H., (2017). Complete Reference Java, 8th Ed., Tata McGraw Hill • Horlzner S.,(2006). Java 2 Programming Black Book, Dreamtech Press • Horstmann C., Cornell G. (2000). Core Java Volume-I-Fundamentals, 8th Ed., Prentice Hall, Sun Microsystems Press • Horstmann C, Cornell G. (2008). Core Java Volume-II Advanced Features, 8th Ed., Prentice Hall, Sun Microsystems Press	

F.Y. M.Sc
SEMESTER-II
CS-DSE-524B : Power Bi

Total Hours: 30 **Credits: 2**

Course objectives	To understand and learn: • Data Preparation and Modeling • Data visualization • Report creation • Data Analysis and Exploration • Data Modeling with DAX	
Course outcomes	After After successful completion of this course, students are expected to: • Understanding Power BI gain a solid understanding of the key concepts, components, and capabilities of Power BI. • Data Acquisition enables to connect to various data sources, import data into Power BI, and perform data transformation and shaping operations. • PowerBi aquire skills in creating efficient data models using Power BI's modeling capabilities., including relationships, calculated columns, measures, and hierarchies. • Develop the ability to create visually appealing and interactive reports and dashboards using Power BI's wide range of visualization options. • Report Development: Learn how to design and develop reports that effectively communicate insights and enable data-driven decision-making. • Gain proficiency in performing data analysis using Power BI's powerful features.	
Unit	**Content**	**Hours**
Unit I	**Introduction to Power BI and Power Bi Desktop** o Introduction to Data warehouse o Data warehouse Tools o What is Power BI? o Power BI – Flow of Activity o Building Blocks of Power BI o Power BI – Primary Tools : Power Pivot, Power Query, o Power View, Power Map, Power Q&A, Power BI Desktop o Power BI Desktop – Install o Data Sources and Connections o Connect to Data in Power BI Desktop o How to use Query Editor in Power BI o Advanced Data Changes and Transformation o Views in Power BI Desktop	**7**

	○ Modeling Data - Manage Data Relationship, ○ Create Calculated Columns, Optimize Data Models	
Unit II	**Data Analysis Expressions (DAX)** ○ What is DAX? ○ Data Types in DAX ○ Calculation Types ○ DAX Functions : Date and Time, Time IIntelligence, ○ Information, Logical, Mathematical, Statistical, Text, ○ Aggregate Measures in DAX ○ Table Relationships and DAX	**8**
Unit III	**Data visualization** ○ Why Data Visualization ○ Practices for Data Visualization ○ How to use Visual in Power BI ○ Reports in Power BI ○ Charts in Power BI (Scatter, Waterfall, Funnel) ○ Slicers ○ Map Visualizations ○ Gauges and Single Number Card	**7**
Unit IV	**Custom visualizations** ○ What Are Custom Visuals? ○ Ofce Store ○ Downloading Custom Visuals ○ Importing Custom Visuals in Power BI Report ○ KPI Visuals ○ Data Binding in Power BI	**8**
Study Resources	• Quintana M., Knight B., Knight D., Pearson M.(2018). Microsoft Power BI Complete Reference, Packt Publishing	

F.Y. M.Sc
SEMESTER-II
CS-DSC-525 : Practical course based on Design and Analysis of Algorithms

Total Hours: 60 **Credits: 2**

Course objectives	Understand and learn • To convert the algorithms to code. • To measure the complexities at run time. • To modify the algorithms for efficiency. • To debug and test the programs.	
Course Outcomes	After successful completion of this course, students are expected to: • Able to construct logic for the algorithms designed using designing techniques. • Able to do posterior analysis of the algorithms. • Able to debug the algorithms. • Modify to improve performance of the algorithms. • Able to test and profile the algorithms.	
Sr. No.	**Content**	**Hours**
1	Write a program for creating max./min. heap using INSERT.	**4**
2	Write a program for creating max./min. heap using ADJUST/HEAPIFY	**4**
3	Write a program to find minimum and maximum form a given array.	**4**
4	Write a program for searching element form given array using binary search for n=1000,2000,3000 find exact time of execution	**4**
5	Write a program forsorting elements in given array using Heap Sort for n=1000,2000,3000 find exact time of execution	**4**
6	Write a program forsorting elements in given array using Merge sort for n=1000,2000,3000 find exact time of execution	**4**
7	Write a program forsorting elements in given array using Quick Sort for n=1000,2000,3000 find exact time of execution	**4**
8	Write a program for matrix multiplication using Strassen's matrix multiplication.	**4**
9	Write a program to find solution of Knapsack instant.	**4**
10	Write a program to find shortest path using single source shortest path.	**4**
11	Write a program to find shortest path using all pair path.	**4**
12	Write a program to find longest common subsequence.	**4**
13	Write a program to implement breadth first.	**4**
14	Write a program to implement depth first traversal.	**4**

15	Write a program to find all solutions for 8-queen problem using backtracking	**4**
Study Resources	• Horowitz E., Sahni S. "Fundamentals of computer Algorithms" Galgotia publications. • Horowitz E., Sahni S. and Rajshekaran S,Computer Algorithms, Computer Science Press. • Dasgupta S., Papadimitriou C., and Vazirani U.(2006), Algorithms. McGraw-Hill publications. • Cormen, Leiserson and Rivest, (2009). Introduction to Algorithms, 3rd Ed. Prentice Hall of India.	

Note: At least 12 experiments should be performed.

F.Y. M.Sc
SEMESTER-II
CS-DSE-526A : Practical course based on Advanced Java Programming

Total Hours: 60 **Credits: 2**

Course objectives	To understand and learn: • Gain knowledge about Advanced Java language syntax and semantics to write Java programs • Understand the fundamentals of collection classes in Java. • Understand the principles of JDBC. • Understand the concept of java servlet and JSP.	
Course Outcomes	After successful completion of this course, students are expected to: • Demonstrating the advanced java program structure. • Implementing JDBC programming. • Implementing java servlet program. • Implementing Java Server Pages.	
Sr. No.	**Content**	**Hours**
1	Write a Java program that demonstrates use of collection class: Array List class.	**4**
2	Write a Java program that demonstrates the use of collection class: Stack class.	**4**
3	Write a Java program that demonstrates the use of collection class: LinkedList class,	**4**
4	Write a Java program that demonstrates the use of collection class: HashSet class	**4**
5	Write a Java program that demonstrates the use of collection class: LinkedHashSet class	**4**
6	Write a Java program that demonstrates the use of collection class: TreeSet class	**4**
7	Write a Java program that demonstrates the use of collection class: HashMap,	**4**
8	Write a Java program that demonstrates the use of collection class: LinkedHashMap,	**4**
9	Write a Java program that demonstrates the use of collection class: TreeMap	**4**
10	Write a Java program that demonstrates JDBC.	**4**
11	Write a Java program that demonstrates JSP to find factorial of given number.	**4**
12	Write a Java program that demonstrates JSP for to check given number is palindrom or not.	**4**
13	Write a Java program that demonstrates JSP for to check given number is Armstrong or not.	**4**
14	Write a Java program that demonstrates JSP to find largest of three numbers.	**4**
15	Write a Java program that demonstrates JSP for to check given number is prime or not.	**4**
Study Resources	• Schildt H., (2017). Complete Reference Java, 8th Ed, Tata McGraw Hill Ed. • Horlzner S.,(2006). Java 2 Programming Black Book, Dreamtech Press	

	• Horstmann C., Cornell G. (2000). Core Java Volume-I-Fundamentals, 8th Ed, Prentice Hall, Sun Microsystems Press • Horstmann C., Cornell G. (2008). Core Java Volume-II Advanced Features, 8th Ed, Prentice Hall, Sun Microsystems Press	

F.Y. M.Sc
SEMESTER-II
CS-DSE-526B : Practical course based on Power Bi

Total Hours: 60 **Credits: 2**

Course objectives	To understand and learn: • Learn how to create visually appealing and interactive reports and dashboards using Power Bi's wide range of visualization tools • Gain knowledge of Power Bi's data modeling capabilities, including importing data from various sources, transforming and shaping data using Power Query Editor • Explore the analytical capabilities of Power Bi, such as using DAX (Data Analysis Expressions) formulas to perform calculations and create calculated columns and measures. • Understand how to connect Power Bi to different data sources, such as databases, Excel files, cloud services, and web APIs.	
Course Outcomes	• Understanding Power Bi gain a solid understanding of the key concepts, components, and capabilities of Power Bi. • Data Acquisition enables to connect to various data sources, import data into Power Bi, and perform data transformation and shaping operations. • PowerBi aquire skills in creating efficient data models using Power Bi's modeling capabilities., including relationships, calculated columns, measures, and hierarchies. • Develop the ability to create visually appealing and interactive reports and dashboards using Power Bi's wide range of visualization options.	
Sr. No.	**Content**	**Hours**
1	Demonstrate the installation of Power Bi Desktop.	**4**
2	Demonstrate how to connect to data on web.	**4**
3	Demonstrate to connect to data from various sources.	**4**
4	Demonstrate Removing and filtering rows in query editor of PowerBi	**4**
5	Demonstrate removing rows with Null values in PowerBi	**4**
6	Demonstrate Removing rows with blank values in PowerBi	**4**
7	Demonstrate Filtering rows based on condition in PowerBi.	**4**
8	Demonstrate Removing columns, Splitting columns in PowerBi.	**4**
9	Demonstrate Replacing values in PowerBi.	**4**
10	Demonstrate Cleaning, transforming, and load data in Power Bi	**4**
11	Calculate Cumulative Values with DAX using PowerBi	**4**
12	Demonstrate various charts drawing in PowerBi on a data.	**4**

13	Create ArcGIS maps in PowerBi	**4**
14	Demonstate using Slicer and deactivating slicer in PowerBi	**4**
15	Create quick reports in the Power Bi	**4**
Study Resources	• Quintana M., Knight B., Knight D., Pearson M. (2018). Microsoft Power BI Complete Reference, Packt Publishing	

Note: At least 12 experiments should be performed.

F.Y. M.Sc
SEMESTER-II
CS-OJT-527 : On Job Training / Internship

Total Hours: 120 **Credits: 8**

Course objectives	To understand and learn: • To provide the students with actual work experience • To make aware prescribe standards and guidelines at work • **To develop the employability of participating student** • To avail an opportunities to eventually acquire job experiences
Course outcomes	After successful completion of this course, students are expected to: • Get actual work experience with office and virtual exposure to various management styles, technical, industrial, and procedural systems • Acquaint the knowledge related to working hours, work protocols and guidelines • Understand the roles and responsibilities of employee as well as team work • Justify job experiences that match their potentials, skills, and competencies
	Internship An internship is a professional learning experience that offers meaningful, practical work related to a student's field of study or career interest. An internship gives a student the opportunity for career exploration and development, and to learn new skills. **On the job training** On the job training is a form of training provided at the workplace. During the training, employees are familiarized with the working environment they will become part of. Employees also get a hands-on experience using machinery, equipment, tools, materials, etc.