MVJCE CURRICULUM

FOR

COMPUTER SCIENCE & ENGINEERING (Scheme 2019)

IV SEMESTER

Course Title	**OPERATIONS RESEARCH, NUMERICAL AND STATISTICAL** METHODS	Semester	04
Course Code	MVJ19MCS41	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	3 (L : T : P :: 3 : 0 : 0)	Total	100
Credits	3	**Exam. Duration**	3 Hours

Course objective is to:

The purpose of this course is to make students well conversant with numerical methods to solve ordinary differential equations, complex analysis, sampling theory Operational research emerging in science and engineering.

Module–1	L1,L2, L3	**Hours 8**

Numerical solution of Ordinary Differential Equations of first order and first degree: Picard's method, Taylor's series method, Modified Euler's method, Runge–Kutta method of fourth order, Predictor and Corrector method: Milne's Method.

Module–2	L1,L2, L3	**Hours 8**

NUMERICAL METHODS–2:

Numerical solution of Ordinary Differential Equations of second order : Picard's method, Runge–Kutta method of fourth order, Predictor and Corrector method: Milne's Method.

Calculus of Variations: Variation of function and Functional, variational problems. Euler's equation, Geodesics, hanging chain, problems.

Module–3	L1,L2, L3	**Hours** 8

OPERATIONS RESEARCH–1

Introduction to Linear Programming Problem (LPP): Prototype example, Assumptions of LPP, Formulation of LPP and Graphical method various examples. the simplex method, Big M method, Two

phase method and dual simplex method		
Module–4	L1,L2 L3	**Hours 8**
OPERATIONS RESEARCH–2 The transportation problem: Initial Basic Feasible Solution (IBFS) by North West Corner Rule method, Matrix Minima Method, Vogel's Approximation Method. **Game Theory**: The formulation of two persons, zero sum games; saddle point, maximin and minimax principle, Solving simple games– a prototype example; Games with mixed strategies; Graphical solution procedure		
Module–5	L1,L2,L3	**Hours 8**
STATISTICAL METHODS Fitting of the curves of by the method of least square, Correlation and Regression , Regression coefficients, line of regression problems. **Curve fitting by the method of least squares, Fitting of the curves of the form = + , = 2 + + , = .**		

Course Outcomes:	
CO1	Solve first and second order ordinary differential equation arising in flow problems using single step and multistep numerical methods.
CO2	Determine the extremals of functionals and solve the simple problems of the calculus of variations.
CO3	Solve the mathematical formulation of linear programming problem.
CO4	Solve the applications of transport problems and theory of games.
CO5	Fit a suitable curve by the method of least squares and determine the lines of regression for a set of statistical data.

Text Books:	
1	B.S. Grewal, "Higher Engineering Mathematics" Khanna Publishers, 43rd Edition, 2013.
2	Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley –India publishers, 10th edition,2014.

Reference Books:	
1	Ramana B. V. "Higher Engineering Mathematics" Tata Mc Graw–Hill, 2006.
2	Ball N. P. & Manish Goyal, "A text book of Engineering Mathematics", Laxmi Publications, 8th Edition
3	Jain R. K. & Iyengar S.R.K., Advanced Engineering Mathematics, Narosa Publishing House, 2002.
4	S. D. Sharma, "Operations Research", Kedar Nath and Ram Nath Publishers, Seventh Revised Edition 2014.

CIE Assessment:
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SEE Assessment:
Question paper for the SEE consists two parts i.e. Part A and Part B. Part A is compulsory and consists of objective type or short answer type questions of 1 or 2 marks each for total of 20 marks covering the whole syllabus. Part B also covers the entire syllabus consisting of five questions having choices and may contain sub–divisions, each carrying 16 marks. Students have to answer five full questions. One question must be set from each unit. The duration of examination is 3 hours.

CO–**PO/PSO Mapping**														
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	3	-	-	-	-	-	-	-	1	1	-
CO2	3	2	-	3	-	-	-	-	-	-	-	-	-	1
CO3	3	3	-	2	-	-	-	-	-	-	-	-	2	-
CO4	2	3	-	3	-	-	-	-	-	-	-	1	-	-
CO5	3	3	-	3	-	-	-	-	-	-	-	1	2	-

High–3, Medium–2, Low–1

Course Title	**ANALYSIS AND DESIGN OF** ALGORITHMS	Semester	04
Course Code	MVJ19CS42	CIE	50
Total No. of Contact Hours	50	SEE	50
No. of Contact Hours/week	4 (L : T : P :: 3 : 2: 0)	Total	100
Credits	4	**Exam.** Duration	3 Hours

Course objective is to:

- Identify the importance of different asymptotic notation.
- Determine the complexity of recursive and non−recursive algorithms.
- Compare the efficiency of various design techniques like greedy method, backtracking etc.
- Apply appropriate method to solve a given problem.

Module−1	L1,L2	**Hours 8**

Basic Concept of Algorithms: Introduction−What is an Algorithm, Algorithm Specification, Analysis Framework, Performance Analysis: Space complexity, Time complexity. Asymptotic Notations: Big−Oh notation (O), Omega notation ( ), Theta notation ( ), and Little−oh notation (o), Mathematical analysis of Non−Recursive and recursive Algorithms with Examples . Important Problem Types. Fundamental Data Structures.

Applications: developing computational tools and bioinformatics software, Mathematics.

Video link / Additional online information (related to module if any):

http://www.nptelvideos.com/video.php?id=1442

https://nptel.ac.in/courses/106105085/

Module−2	L2, L4	**Hours 8**

Simple Design Techniques Brute force : Selection sort, Bubble sort, Sequential Search and Brute−Force String Matching , Exhaustive search Traveling Salesman problem, Knapsack problem , Assignment Problem.

Divide and Conquer: General method, Binary search, Recurrence equation for divide and conquer, Finding the maximum and minimum , Merge sort, Quick sort , Strassen's matrix multiplication , Advantages and Disadvantages of divide and conquer.

Applications: power distribution (electrical field), Online shopping and delivery (real time)

Video link / Additional online information (related to module if any):

1. https://nptel.ac.in/courses/106102064/
2. https://www.youtube.com/watch?v=MFfD57DTDQY

Module-3	L3	**Hours 8**

Decrease and Conquer approach: Topological Sort, Decrease-by-a-Constant-Factor Algorithms: Josephus Problem.

Greedy Method: General method, Coin Change Problem, Knapsack Problem, Job sequencing with deadlines. Minimum cost spanning trees: Prim's Algorithm, Kruskal's Algorithm. Single source shortest paths: Dijkstra's Algorithm. Huffman Trees and Codes.

Laboratory Sessions/ Experimental learning: Solving real time problems using Greedy Technique.

Applications: Optimization Problems.

Video link :https://nptel.ac.in/courses/106/106/106106131/

Module-4	L2	**Hours 8**

Dynamic Programming: General method with Examples, Multistage Graphs. Transitive Closure: Warshall's Algorithm, All Pairs Shortest Paths: Floyd's Algorithm, Optimal Binary Search Trees, Knapsack problem, Bellman-Ford Algorithm , Travelling Sales Person problem , Reliability design.

Laboratory Sessions/ Experimental learning: Solving real time problems using Dynamic Programming.

Applications: Computer Networks.

Video link:https://nptel.ac.in/courses/106/106/106106131/

Module-5	L1, L3	**Hours 8**

Backtracking: General method, N-Queens problem, Sum of subsets problem, Graph coloring, Hamiltonian cycles Programme and Bound: Assignment Problem, Travelling Sales Person problem, 0/1 Knapsack problem.

LC Programme and Bound solution : FIFO Programme and Bound solution. NP-Complete and NP-Hard problems: Basic concepts, non-deterministic algorithms, P, NP, NP-Complete, and NP-Hard classes.

Laboratory Sessions/ Experimental learning: Solving real time problems using Backtracking Technique.

Applications: To solve puzzles such as crosswords, Sudoku etc.

Video link:https://nptel.ac.in/courses/106/106/106106131/

Course Outcomes:

CO1	Describe the need of algorithm and the notations used in design analysis.
CO2	Compare the efficiency of brute force, divide and conquer techniques for problem solving.
CO3	Ability to apply greedy algorithms, hashing and string matching algorithms.

CO4	Ability to design efficient algorithms using various design techniques.
CO5	Ability to apply the knowledge of complexity classes P, NP, and NP Complete and prove certain problems are NP–Complete.

Text Books:	
1	Introduction to the Design and Analysis of Algorithms, Anany Levitin:, 2rd Edition, 2009. Pearson.
2	Introduction to Algorithms, Thomas H. Cormen, Charles E. Leiserson, Ronal L. Rivest, Clifford Stein, 3rd Edition, PHI.

Reference Books:	
1	Design and Analysis of Algorithms, S. Sridhar, Oxford (Higher Education).
2	http://jeffe.cs.illinois.edu/teaching/algorithms/
3	Computer Algorithms/C++, Ellis Horowitz, Satraj Sahni and Rajasekaran, 2nd Edition, 2014, Universities Press.

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- Quizzes/mini tests (4 marks)
- Mini Project / Case Studies (8 Marks)
- Activities/Experimentations related to courses (8 Marks)

SEE Assessment:

Question paper for the SEE consists two parts i.e. Part A and Part B. Part A is compulsory and consists of objective type or short answer type questions of 1 or 2 marks each for total of 20 marks covering the whole syllabus.

Part B also covers the entire syllabus consisting of five questions having choices and may contain sub–divisions, each carrying 16 marks. Students have to answer five full questions.

One question must be set from each unit. The duration of examination is 3 hours.

CO–**PO/PSO Mapping**														
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	--	--	--	1	--	--	--	--	--	--	2	2	-
CO2	2	3	--	--	2	--	--	--	--	--	--	--	2	-
CO3	3	3	2	2	--	--	--	--	--	--	--	2	2	2
CO4	3	3	3	--	--	--	--	--	1	--	--	2	3	2
CO5	2	2	2	1	3	--	--	--	--	--	--	3	3	3

High–3, Medium–2, Low–1

Course Title	**SOFTWARE ENGINEERING**	Semester	04
Course Code	MVJ19CS43	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	3 (L : T : P :: 3 : 0 : 0)	Total	100
Credits	3	**Exam. Duration**	3 Hours

Course objective is to: ***The students will be able to***

- Understand principles, concepts, methods, and techniques of the software engineering approach to producing quality software (particularly for large, complex systems).
- Impart skills in the design and implementation of efficient software systems across disciplines.
- Familiarize engineering practices and standards used in developing software products and components.
- Gather knowledge on various software testing, maintenance methods.

Module–1	L1,L2, L3	**Hours 8**

FUNDAMENTALS OF SOFTWARE ENGINEERING AND REQUIREMENTS ENGINEERING: Software Engineering Fundamentals; Software processes: Software life–cycle models; Software requirements and specifications: Requirements elicitation; Requirements analysis modeling techniques; Functional and non–functional requirements; User requirements, System requirements, requirement validation and software requirement specification document. Prototyping – Basic concepts of formal specification techniques.

Laboratory Sessions/ Experimental learning:

To write the SRS for the given real time application using report writing tools.

Applications: In Software development process.

Video link / Additional online information: https://nptel.ac.in/courses/106105182/

Module–2	L1,L2, L3	**Hours 8**

SOFTWARE DESIGN: Fundamental design concepts and principles; Design characteristics; System Models – Context, Behavioral, Data and, Object models, Architectural design– System structuring, Control models; Structured design; Object–oriented analysis and design; User interface design; Design for reuse; Design patterns;

Laboratory Sessions/ Experimental learning:

Draw a class diagram, object diagram, Use case diagram, Sequence diagram and activity diagram for the given real time application using rational rose tool.

Applications: In Software development process.

Video link / Additional online information:

https://www.coursera.org/lecture/client-needs-and-software-requirements/3-2-4-use-cases-bZNCr

Module-3	L1,L2, L3	**Hours 8**

SOFTWARE VALIDATION AND MAINTENANCE :

Software validation: Validation planning; Testing fundamentals, including test plan creation and test case generation; Black-box and white-box testing techniques; Unit, integration, validation, and system testing; Object-oriented testing; Inspections.

Software evolution: Software maintenance; Characteristics of maintainable software; Reengineering; Legacy systems; Software reuse.

Laboratory Sessions/ Experimental learning:

Using Selenium IDE write a test suite containing minimum 4 test cases.

Applications: In Software development process.

Video link / Additional online information: https://www.youtube.com/watch?v=T3q6QcCQZQg

Module-4	L1,L2, L3	**Hours 8**

COMPONENT BASED SOFTWARE ENGINEERING : Engineering of Component-Based Systems; The CBSE Process; Domain Engineering; Component-Based Development; Classifying and Retrieving Components; Economics of CBSE

Laboratory Sessions/ Experimental learning: Create a project using MS projects for any real time scenario.

Applications: In Software development process.

Video link / Additional online information: https://youtu.be/tIZ1dg4pxCE

Module-5	L1,L2, L3	**Hours 8**

SOFTWARE QUALITY PROCESS IMPROVEMENT : Overview of Quality management and Process Improvement; Overview of SEI -CMM, ISO 9000, CMMI, PCMM, TQM and Six Sigma; overview of CASE tools. Software tools and environments: Programming environments; Project management tools; Requirements analysis and design modelling tools; testing tools; Configuration management tools;

Laboratory Sessions/ Experimental learning: Estimation of test coverage metrics using manual test metrics.

Applications: In Software development process.

Video link / Additional online information: https://nptel.ac.in/courses/110105039/

Course Outcomes:

CO1	Comprehend software development life cycle and Prepare SRS document for a project
CO2	Apply software design and development techniques
CO3	Identify verification and validation methods in a software engineering project

CO4	Apply on Component based software development process.
CO5	Involve in continuous learning to solve issues of process and software product using the advanced CASE tools and techniques.

Text Books:	
1	Ian Sommerville, "Software Engineering", 9th Edition, Addison– Wesley, 2011
2	R. S. Pressman, Software Engineering, a practitioner's approach, McGraw Hill,7th Edition, 2010
Reference Books:	
1	Rajib Mall, "Fundamentals of Software Engineering", PHI Publication, 3rd edition, 2009
2	Pankaj Jalote: An Integrated Approach to Software Engineering, Wiley India.

CIE Assessment:

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- Quizzes/mini tests (4 marks)
- Mini Project / Case Studies (8 Marks)
- Activities/Experimentations related to courses (8 Marks)

SEE Assessment:

i. Question paper for the SEE consists two parts i.e. Part A and Part B. Part A is compulsory and consists of objective type or short answer type questions of 1 or 2 marks each for total of 20 marks covering the whole syllabus.

ii. Part B also covers the entire syllabus consisting of five questions having choices and may contain sub–divisions, each carrying 16 marks. Students have to answer five full questions.

iii. One question must be set from each unit. The duration of examination is 3 hours.

CO–**PO/PSO Mapping**														
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	2	2	-	-	1	2	2	2	-	2	-
CO2	2	2	2	2	2	1	-	1	2	2	2	1	2	2
CO3	2	2	2	2	2	1	-	1	2	2	2	-	3	-

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

High–3, Medium–2, Low–1

Course Title	**OPERATING SYSTEMS**	Semester	04
Course Code	MVJ19CS44	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	3 (L : T : P :: 3 : 0 : 0)	Total	100

Credits	3	**Exam. Duration**	3 Hours

Course objective is to: ***The students will be able to***

- Introduce concepts and terminology used in OS.
- Explain threading and multithreaded systems.
- Illustrate process synchronization and concept of Deadlock.
- Introduce Memory and Virtual memory management, File system and storage techniques.

Module–1	L2	**Hours 8**

Introduction: What operating systems do; Computer System organization; Computer System architecture; Operating System operations; Distributed system; Special–purpose systems; Computing environments. Operating System Services; User – Operating System interface; System calls; Types of system calls; System programs; Operating system design and implementation; Operating System structure; Virtual machines; System boot.

Process Management: Process concept; Process scheduling; Operations on processes;Inter process communication.

Module–2	L2	**Hours 8**

Multi–**threaded Programming**: Overview; Multithreading models; Thread Libraries; Threading issues. Process Scheduling: Basic concepts; Scheduling Criteria; Scheduling Algorithms; Multiple–processor scheduling; Thread scheduling.

Process Synchronization: Synchronization: The critical section problem; Peterson's solution; Synchronization hardware; Semaphores; Classical problems of synchronization; Monitors.

Module–3	L3	**Hours 8**

Deadlocks : Deadlocks; System model; Deadlock characterization; Methods for handling deadlocks; Deadlock prevention; Deadlock avoidance; Deadlock detection and recovery from deadlock.

Memory Management: Memory management strategies: Background; Swapping; Contiguous memory allocation; Paging; Structure of page table; Segmentation

Module–4	L3	**Hours 8**

Virtual Memory Management: Background; Demand paging; Copy–on–write; Page replacement; Allocation of frames; Thrashing.

File System, Implementation of File System: File system: File concept; Access methods; Directory structure; File system mounting; File sharing;

Implementing File system: File system structure; File system implementation; Directory implementation; Allocation methods; Free space management.

Module–5	L3	**Hours 8**

Mass Storage Structure–Disk Structure – Disk Attachment–Disk Scheduling–Disk Management– Swap–Space Management. Protection: Domain of protection, Access matrix, Implementation of access matrix, Access control, Revocation of access rights, Capability– Based systems. **Case Studies:** Windows, Unix, Linux, Android.		
List of Practical Experiments/Hands–on :	L2	**Hours 10**
Creating processes in Unix with commands like Fork and Exec; Pipes and process communication; Performance study of various CPU scheduling algorithms; Performance study of various Disk scheduling algorithms. Analysis various memory management techniques and page replacement policies.		

Course Outcomes:	
CO1	Illustrate the fundamental concepts of operating systems
CO2	Compare and illustrate various process scheduling algorithms.
CO3	Ability to recognize and resolve Deadlock problems ,Memory Management techniques.
CO4	Apply appropriate memory and file management schemes.
CO5	Appreciate the need of access control and protection in Operating System and illustrate various disk scheduling algorithms.

Text Books:	
1	Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, Operating System Concepts 7th edition,Wiley–India, 2006
2	D.M Dhamdhere, Operating Systems: A Concept Based Approach 3rd Ed, McGraw– Hill, 2013.

Reference Books:	
1	Tanenbaum, A., "Modern Operating Systems", Prentice–Hall of India. 2004
2	P.C.P. Bhatt, An Introduction to Operating Systems: Concepts and Practice 4th Edition,

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compulsory and consists of objective type or short answer type questions of 1 or 2 marks each for total of 20 marks covering the whole syllabus.

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iii. One question must be set from each unit. The duration of examination is 3 hours.

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

High–3, Medium–2, Low–1

Course Title	**MICRO CONTROLLER AND EMBEDDED SYSTEMS**	Semester	04
Course Code	MVJ19CS45	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	3(L : T : P :: 3 : 0 : 0)	Total	100
Credits	3	**Exam.** Duration	3 Hours

Course objective is to: ***The students will be able to***

- Explain the fundamentals of ARM based system, basic hardware components, selection methods and attributes of an ARM Controller.

- Program ARM controller using the various instructions.
- Explain the fundamentals of Exception, Interrupt Handling and Memory Management Unit of ARM Controller.
- Identify the Embedded System Design applications.
- Explain the real time operating system for the embedded system design.

Module–1	L1,L2, L3	**Hours 8**

Arm Embedded Systems

Prerequisites: **ARM DESIGN PHILOSOPHY,ARM DATAFLOW MODEL**

Microprocessors versus Microcontrollers, ARM Embedded Systems: The RISC design philosophy, The ARM Design Philosophy, Embedded System Hardware, Embedded System Software.

ARM Processor Fundamentals: Registers, Current Program Status Register, Pipeline, Exceptions, Interrupts, and the Vector Table , Core Extensions

Activity:1.Comparision of Microprocessor and Microcontroller hardware Model
2.Comparing the Microprocessor and Microcontroller Software Model

Module–2	L1,L2, L3	**Hours 8**

ARM Instruction Set and Programming

Prerequisites: **ARM INSTRUCTION SET,ARM ASSEMBLY PROGRAMMING**

Introduction to the ARM Instruction Set : Data Processing Instructions , Programme Instructions, Software Interrupt Instructions, Program Status Register Instructions, Coprocessor Instructions, Loading Constants

ARM programming using Assembly language: Writing Assembly code, Profiling and cycle counting, instruction scheduling

Activity: 1.Writing ARM Assembly program for Embedded System Applications

Module–3	L1,L2, L3	**Hours 8**

Interrupt and Memory Management Unit:

*Prerequisites :*Interrupt, Exception, **Memory Management unit**

Exception, Interrupt Handling : Exception handling, Interrupts, Interrupt handling Schemes

Memory Management Unit : The Memory Hierarchy and Cache Memory, Cache Architecture, Cache Policy, Moving from MPU to an MMU, How Virtual Memory Works, Details of ARM MMU

Activity:

1) Use of External interrupt0 to turn ON/OFF led connected to Pin P1.25 of ARM Processor.
2) Use of Software Interrupt SWI instruction in programming.
3) Calculating physical memory address from logical address.

Module–4	L1,L2, L3	**Hours 8**

Prerequisites: Embedded systems ,Embedded Applications

Embedded System Components: Embedded Vs General computing system, History of embedded

systems, Classification of Embedded systems, Major applications areas of embedded systems, purpose of embedded systems Core of an Embedded System including all types of processor/controller, Memory, Sensors, Actuators, LED, 7 segment LED display, stepper motor, Keyboard, Push button switch, Communication Interface (on board and external types), Embedded firmware, Other system components. **Activity:Case Study** – Digital Clock, Battery operated Smartcard Reader		
Module–5	L1,L2, L3	**Hours 8**
Prerequisites: Real time operating system **Real Time Operating System (RTOS) based Embedded System Design:** Operating System basics, Types of operating systems, Task, process and threads (Only POSIX Threads with an example program), Thread pre–emption, Multiprocessing and Multitasking, Task Communication (without any program), Task synchronization issues Racing and Deadlock, Concept of Binary and counting semaphores (Mutex example without any program), How to choose an RTOS **Activity:** Case Study: Automated Meter Reading System (AMR) and Digital Camera, Real time concepts		

Course outcomes:	
CO1	Describe the architectural features and instructions of ARM microcontroller
CO2	Develop Assembly Programs in ARM for Embedded applications.
CO3	Describe the fundamentals of Exception, Interrupt Handling and Memory Management Unit of ARM Controller
CO4	Interface external devices and I/O with ARM microcontroller.
CO5	Demonstrate the need of real time operating system for embedded system applications

Text Books:	
1	Andrew N Sloss, Dominic Symes and Chris Wright, ARM system developer's guide, Elsevier, Morgan Kaufman publishers, 2008.
2	Shibu K V, "Introduction to Embedded Systems", Tata McGraw Hill Education, Private Limited, 2nd Edition.

Reference Books:	
1	Raghunandan.G.H, Microcontroller (ARM) and Embedded System, Cengage learning Publication, 2019
2	The Insider's Guide to the ARM7 Based Microcontrollers, Hitex Ltd., 1st edition, 2005.

3	Raj Kamal, Embedded System, Tata McGraw–Hill Publishers, 2nd Edition, 2008.

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

High–3, Medium–2, Low–1

Course Title	**DATA COMMUNICATION**	Semester	04
Course Code	MVJ19CS46	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	3 (L : T : P :: 3 : 0 : 0)	Total	100
Credits	3	**Exam.** Duration	3 Hours

Course objective is to:

- Define the protocol layering and physical level communication.
- To demonstrate the performance of a network.
- To be familiar the various components required to build different networks.
- To learn the functions of transport layer protocols to provide reliable communication.
- To familiarize the protocols of the Application layer.

Module–1	L1,L2, L3	**Hours 8**

INTRODUCTION AND PHYSICAL LAYER: Introduction: Networks Network Types Protocols and Standards TCP/IP Protocol suite OSI Model, Data Encoding: Line Encoding–Types of Line Coding–Analog–to–Digital Conversion– Pulse code modulation (PCM)–Delta modulation (DM)–Transmission

Modes.

Laboratory Sessions/ Experimental learning: Design the simulation system for performing analog to digital conversion.

Applications: Mobile Phone, Laptop and all electronic devices

Video link / Additional online information (related to module if any):https://www.digimat.in/nptel/courses/video/106105183/L01.html

Module-2	L1,L2	**Hours 8**

DATA-**LINK LAYER :** Introduction Link-Layer Addressing DLC Services Error Detection and Correction: Introduction, Block coding, Cyclic codes, Checksum. Error Correction and Detection Protocols: Protocols for Noiseless Channels- Simplest protocol, Stop-and-wait protocol; Protocols for Noisy Channels- Stop-and-wait automatic repeat request, Go back N automatic repeat request, Selective repeat automatic repeat request.

Laboratory Sessions/ Experimental learning: Develop the system for error correction code (like CRC) and verify the reliability of data at both sides.

Applications: Telecommunication

Video link / Additional online information (related to module if any):

https://www.youtube.com/watch?v=pVl1L1jrbFE

Module-3	L1,L2, L3	**Hours 8**

MEDIA ACCESS CONTROL: Media Access control: Random Access, Controlled Access and Channelization, Wired LANs Ethernet: Ethernet Protocol, Standard Ethernet, Fast Ethernet, Gigabit Ethernet and 10 Gigabit Ethernet, Wireless LANs: Introduction, IEEE 802.11 Project and Bluetooth.

Laboratory Sessions/ Experimental learning: Create the virtual environment for WLAN and make the data communication between stations.

Applications: Making communication between devices

Video link / Additional online information (related to module if any):

https://www.youtube.com/watch?v=5u52wbqBgEY

Module-4	L1,L2, L3	**Hours 8**

NETWORK LAYER: Network Layer Services Packet switching Performance IPV4 Addresses – Forwarding of IP Packets, IP Addressing Scheme- Subnet Addressing-Subnet Masks-IPV4 Addressing-IPV6 Addressing- Address Resolution Protocol (ARP)-Reverse Address Resolution Protocol (RARP)

Laboratory Sessions/ Experimental learning: Write a code finding the physical address and logical address of the system using ARP /RARP protocols.

Applications: Resolve addressing problem in systems

Video link / Additional online information (related to module if any):

https://www.youtube.com/watch?v=rW1jPlYgp_0

Module–5	L1,L2, L3	**Hours 8**

TRANSPORT LAYER : Introduction Services of Transport Layer, Connection Establishment, Connection Release, Transport Layer Protocols– TCP protocol, UDP protocol; Congestion: TCP Congestion control Congestion avoidance (DEC bit, RED)

Laboratory Sessions/ Experimental learning: Create the system for avoiding congestion in unreliable communication.

Applications: Reliable communication among devices in network like LAN,WAN etc.

Video link / Additional online information (related to module if any): https://www.youtube.com/watch?v=z_lCsUGwr3U

Course outcomes:

CO1	Identify the components required to build different types of networks.
CO2	Choose the required functionality at each layer for given application
CO3	Identify solutions for each functionality at each layer
CO4	Trace the flow of information from one node to another node in the network.
CO5	Analyse the working of various application layer protocols

Text Books:

1	Behrouz A. Forouzan, Data Communications and Networking 5E, 5th Edition, Tata McGraw–Hill, 2013.
2	Larry L. Peterson and Bruce S. Davie: Computer Networks A Systems Approach, 5th Edition, Morgan Kaufmann Publishers Inc, 2012.

Reference Books:

1	William Stallings, Data and computer communication Networks, Second edition, Pearson education, 2013.
2	Ying–Dar Lin, Ren–Hung Hwang, Fred Baker, "Computer Networks: An Open Source Approach",Mc Graw Hill Publisher, 2011.

CIE Assessment:

CIE is based on quizzes, tests, assignments/seminars and any other form of evaluation. Generally, there will be: Three Internal Assessment (IA) tests during the semester (30 marks each), the final IA marks to be awarded will be the average of three tests

- Quizzes/mini tests (4 marks)
- Mini Project / Case Studies (8 Marks)
- Activities/Experimentations related to courses (8 Marks)

SEE Assessment:

i. Question paper for the SEE consists two parts i.e. Part A and Part B. Part A is compulsory and consists of objective type or short answer type questions of 1 or 2 marks each for total of 20 marks covering the whole syllabus.

ii. Part B also covers the entire syllabus consisting of five questions having choices and may contain sub–divisions, each carrying 16 marks. Students have to answer five full questions.

iii. One question must be set from each unit. The duration of examination is 3 hours.

CO–**PO/PSO Mapping**														
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	1	-	-	-	-	-	-	2	-	-	-
CO2	2	2	2	1	-	-	-	-	-	-	2	1	2	-
CO3	2	2	2	1	-	-	-	-	-	-	2	-	-	-
CO4	1	2	2	1	-	-	-	-	-	-	2	1	2	-
CO5	1	2	2	1	-	-	-	-	-	-	2	2	3	-

High–3, Medium–2, Low–1

Course Title	**ANALYSIS AND DESIGN OF ALGORITHMS LAB**	Semester	04
Course Code	MVJ19CSL47	CIE	50
Total No. of Contact Hours	30	SEE	50
No. of Contact Hours/week	3(L : T : P :: 0 : 2 : 2)	Total	100
Credits	2	**Exam. Duration**	3 Hours

Course objective is to:

- Employ various design strategies for problem solving.
- Provide exposure to measure and compare the performance of different algorithms.
- Provide design and implement various Concepts in JAVA.

S No	Experiment Name	RBT Level	Hours
1	Write a recursive program to a. Solve Towers–of–Hanoi problem b.GCD	L3	3
2	Write a Java program to implement the Stack using arrays. Write Push(), Pop(), and Display() methods to demonstrate its working.	L3	3
3	Implement Recursive Binary search and Linear search and determine the time required to search an element. Repeat the experiment for different values of N and plot a graph of the time taken versus N.	L3	3
4	Given a set of N integer elements which is to be sorted using Selection Sort technique. Write the program using C language as well as in Java for different values of N and observe the total time	L3	3

	taken to sort the elements in both the languages.		
5	Write program to do the following: a. Print all the nodes reachable from a given starting node in a digraph using BFS method. b. Check whether a given graph is connected or not using DFS method.	L3	3
6	The Merge sort is one of the most common algorithms used to sort arrays. The class Merge sort implements this algorithm. However, there is a bug in the implementation of the method sort. Debug the previous implementation using the debugging options of your favourite IDE (e.g. eclipse), in order to find the error.	L3	3
7	Sort a given set of N integer elements using Quick Sort technique and Run the program for different values of N and record the time taken to sort.	L3	3
8	We are given a set of items, each with a weight and a value and we need to determine the number of each items to include in a collection so that the total weight is less than or equal to the given limit and the total value is as large as possible. Write a Java program by applying any reuse sub problem technique to find the solution.	L3	3
9	Suppose you're trying to find the shortest path from your house to various locations like Movie theatre, Gas Station, Grocery Store and Petrol pump. If we let various locations be vertices and the routes between them are edges, we can create a weighted graph representing the situation. Write a Java program to find the shortest path from your house (source) to the remaining locations.	L3	3
10	Write a Java program for the following Scenario, You have a business with several offices and you want to lease phone lines to connect them up with each other; and the phone company charges different amounts of money to connect different pairs of cities. You want a set of lines that connects all your offices with a minimum total cost and it should be a spanning tree.	L3	3
11	Develop a program in Java with a given set of vertices V in a weighted graph where each edge w (u,v) can be negative, find the	L3	3

	shortest path weights d(s,v) from every source s to all vertices in the graph. If the graph contains negative cycle, report it.		
12	Given a set of cities and distance between every pair of cities, the problem is to find the shortest possible route that visits every city exactly once and returns to the starting point. Write a program to find the solution using dynamic programming method.	L3	3
13	Given a set of positive integers and an integer 's' write a program in Java to determine whether there is any non−empty subset whose sum is 's'.	L3	3
14	Write a Java program to find a path that traverses all the vertices of the given graph G exactly once and then ends at the starting vertex in a connected undirected Graph G of *n* vertices using backtracking principle.	L3	3

Course Outcomes:	
CO1	Design algorithms using appropriate design techniques (brute−force, greedy, dynamic programming, etc.)
CO2	Implement a variety of algorithms such as sorting, graph related, combinatorial, etc., in a high level language.
CO3	Analyze and compare the performance of algorithms using language features.
CO4	Apply and implement learned algorithm design techniques and data structures to solve real−world problems.
CO5	Employ various design strategies for problem solving and implement various algorithms in JAVA .

Reference Books:	
1	Design and Analysis of Algorithms, S. Sridhar, Oxford (Higher Education).
2	http://jeffe.cs.illinois.edu/teaching/algorithms/

CIE Assessment:
Regular Lab work :20 Record writing :5 Lab Tests(Minimum 2 tests shall be conducted for 15 marks and average of two will be taken) Viva 10 marks

SEE Assessment:
Examinations will be conducted for 100 marks and scaled–down to 50. The weightage shall be, i. Writeup : 20 marks ii. Conduction : 40 marks iii. Analysis of results : 20 marks iv. Viva : 20

CO–**PO/PSO Mapping**														
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	-	-	-	-	-	3	-	2	2	2	-
CO2	3	3	2	-	-	-	-	-	3	-	2	2	1	2
CO3	3	3	2	-	-	-	-	-	3	-	2	2	3	-
CO4	3	3	2	-	-	-	-	-	3	-	2	2	2	3
CO5	3	3	2	-	-	-	-	-	3	-	2	2	2	3

High–3, Medium–2, Low–1

Course Title	**MICRO CONTROLLER AND EMBEDDED SYSTEMS LAB**	Semester	04
Course Code	MVJ19CSL48	CIE	50
Total No. of Contact Hours	30	SEE	50
No. of Contact Hours/week	3(L : T : P :: 0 : 2 : 2)	Total	100
Credits	2	**Exam. Duration**	3 Hours

Course objective is to: ***The students will be able to***

- Demonstrate various real time application using ARM Microcontroller hardware
- Develop programming languages for any real time scenario using Arm Microcontroller

S No	**Experiment** Name	**RBT Level**	Hours
1	Write a program to find the sum of first 10 integer numbers.	L3	3
2	Write a program to find factorial of a number.	L3	3
3	Write a program to add an array of 16 bit numbers and store the 32 bit result in internal RAM	L3	3
4	Write a program to find the square of a number (1 to 10) using look–up table.	L3	3
5	Write a program to find the largest/smallest number in an array of 32 numbers.	L3	3
6	Write a program to arrange a series of 32 bit numbers in ascending/descending order	L3	3
7	Write a program to count the number of ones and zeros in two consecutive memory locations	L3	3
8	Write an ARM assembly program that checks if a 32–bit number is a palindrome. Assume that the input is available in r 3. The program should set r 4 to 1 if it is a palindrome, otherwise r 4 should have 0. A palindrome is a number which is the same when read from both sides. For example, 1001 is a 4 bit palindrome.	L3	3
9	Display "Hello World" message using Internal UART	L3	3
10	Interface and Control a DC Motor	L3	3
11	Interface a Stepper motor and rotate it in clockwise and anti–clockwise direction	L3	3
12	Interface a DAC and generate Triangular and Square waveforms.	L3	3
13	Display the Hex digits 0 to F on a 7–segment LED interface, with an	L3	3

	appropriate delay in Between		
	STUDY EXPERIMENT Interface a 4x4 keyboard and display the key code on an LCD	L3	3

Course Outcomes:	
CO1	Develop and test Program using ARM7TDMI/LPC2148 for Real time Scenario's.
CO2	Conduct the experiments on an ARM7TDMI/LPC2148 evaluation board using evaluation version of Embedded 'C' & Keil Uvision–4 tool/compiler and design Real time Embedded Applications.
Reference Books:	
1	Raghunandan.G.H, Microcontroller (ARM) and Embedded System, Cengage learning Publication, 2019
2	The Insider's Guide to the ARM7 Based Microcontrollers, Hitex Ltd., 1st edition, 2005.

CIE Assessment:

Regular Lab work :20

Record writing :5

Lab Tests(Minimum 2 tests shall be conducted for 15 marks and average of two will be taken)

Viva 10 marks

SEE Assessment:

Examinations will be conducted for 100 marks and scaled–down to 50. The weightage shall be,

i. Writeup : 20 marks
ii. Conduction : 40 marks
iii. Analysis of results : 20 marks
iv. Viva : 20

CO–PO/PSO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	-	3	3	-	-	3	-	3	2	1	-
CO2	3	3	2	-	3	3	-	-	3	-	3	2	2	2

High–3, Medium–2, Low–1

Course Title	BALIKE KANNADA	Semester	IV
Course Code	MVJ19BK39	CIE	50
Total No. of Contact Hours	20	SEE	50
No. of Contact Hours/week	1 (L: T: P 1:0:0)	Total	100
Credits	1	Exam. Duration	3 Hrs

Course objective : This course will enable students to understand Kannada and communicate in Kannada language

- Vyavharika Kannada Parichaya (Introduction to Vyavharika kannada)
- Kannada Aksharamaale haagu uchcharane(Kannada Alphabets and Pronounciation.
- Sambhashanegaagi Kannada Padagalu (Kannada Vocubulary for Communication).
- Kannada Grammer in Conversations(Sambhasaneyalli Kannada Vyakarana)
- Activities in Kannada

CHAPTER–1
Vyavharika Kannada Parichaya (Introduction to Vyavharika kannada)
CHAPTER–2
Kannada Aksharamaale haagu uchcharane(Kannada Alphabets and Pronounciation
CHAPTER–3
Sambhashanegaagi Kannada Padagalu (Kannada Vocubulary for Communication)
CHAPTER–4
Kannada Grammer in Conversations(Sambhasaneyalli Kannada Vyakarana)
CHAPTER–5
Activities in Kannada

CIE Assessment:

CIE is based on quizzes, tests, assignments/seminars and any other form of evaluation. Generally, there will be: Three Internal Assessment (IA) tests during the semester (30 marks each), the final IA marks to be awarded will be the average of three tests

- Quizzes/mini tests (4 marks)
- Mini Project / Case Studies (8 Marks)
- Activities/Experimentations related to courses (8 Marks)

SEE Assessment:

i. Question paper for the SEE consists two parts i.e. Part A and Part B. Part A is compulsory and consists of objective type or short answer type questions of 1 or 2 marks each for

total of 20 marks covering the whole syllabus.

ii. Part B also covers the entire syllabus consisting of five questions having choices and may contain sub–divisions, each carrying 16 marks. Students have to answer five full questions.

iii. One question must be set from each unit. The duration of examination is 3 hours.

Course Title	SAMSKRUTHIKA KANNADA	Semester	IV

Course Code	MVJ19SK39	CIE	50
Total No. of Contact Hours	20	SEE	50
No. of Contact Hours/week	1 (L: T: P 1:0:0)	Total	100
Credits	1	**Exam. Duration**	3Hrs

Course Objective : This course will enable students to understand Kannada and communicate in Kannada language

- Samskruthika Kannada Parichaya (Introduction to Adalitha kannada)
- Kannada Kavyagala parichaya (Kannada D Ra Bendre, Siddalingaiha)
- Adalithdalli Kannada Padagalu (Kannada Kagunitha Balake, Patra Lekhana, Prabhandha)
- Kannada Computer Gnyana (Kannada Shabdha Sangraha, Computer Paribashika padagalu)
- Activities in Kannada.

CzsÁåAiÀÄ -1
PÀ£ÀßqÀ ¨sÁµÉ-¸ÀAQë¥ÀÛ «ªÀgÀuÉ.
CzsÁåAiÀÄ -2
¨sÁµÁ ¥ÀæAiÉÆÃUÀ¯ ÁèUÀÄªÀ ¯ ÉÆÃ¥ÀzÉÆÃµÀUÀ¼ÀÄ ªÀÄvÀÄÛ CªÀÅUÀ¼À ¤ªÁgÀuÉ.
CzsÁåAiÀÄ -3
¯ ÉÃR£À aºÉßUÀ¼ÀÄ ªÀÄvÀÄÛ CªÀÅUÀ¼À G¥ÀAiÉÆÃU.À
CzsÁåAiÀÄ -4
¥ÀvÀæ ªÀåªÀºÁgÀ.
CzsÁåAiÀÄ -5
DqÀ½vÀ ¥ÀvÀæUÀ¼ÀÄ.
CzsÁåAiÀÄ -6
¸ÀPÁðgÀzÀ DzÉÃ±À ¥ÀvÀæUÀ¼ÀÄ
CzsÁåAiÀÄ -7
¸ÀAQÃ¥ÀÛ ¥Àæ§AzsÀ gÀZÀ£É, ¥Àæ§AzsÀ ªÀÄvÀÄÛ ¨sÁµÁAvÀgÀ
CzsÁåAiÀÄ -8
PÀ£ÀßqÀ ±À§Ý¸ÀAUÀæºÀ
CzsÁåAiÀÄ -9
PÀA¥ÀÆålgï ºÁUÀÆ ªÀiÁ»w vÀAvÀæeÁÕ£À
CzsÁåAiÀÄ -10
¥Áj¨sÁ¶PÀ DqÀ½vÀ PÀ£ÀßqÀ ¥ÀzÀUÀ¼ÀÄ ªÀÄvÀÄÛ vÁAwæPÀ/PÀA¥ÀÆålgï ¥Áj¨sÁ¶PÀ ¥ÀzÀUÀ¼ÀÄ.
CIE Assessment:

CIE is based on quizzes, tests, assignments/seminars and any other form of evaluation. Generally, there will be: Three Internal Assessment (IA) tests during the semester (30 marks each), the final IA marks to be awarded will be the average of three tests

- Quizzes/mini tests (4 marks)
- Mini Project / Case Studies (8 Marks)
- Activities/Experimentations related to courses (8 Marks)

SEE Assessment:

i. Question paper for the SEE consists two parts i.e. Part A and Part B. Part A is compulsory and consists of objective type or short answer type questions of 1 or 2 marks each for total of 20 marks covering the whole syllabus.

ii. Part B also covers the entire syllabus consisting of five questions having choices and may contain sub–divisions, each carrying 16 marks. Students have to answer five full questions.

iii. One question must be set from each unit. The duration of examination is 3 hours.

Course Title	**ADDITIONAL MATHEMATICS–II**	Semester	IV
Course Code	MVJ19MDSDIP41	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	4	Total	100
Credits	-	**Exam. Duration**	3 HOURS

Course objective is to: This course viz., aims to prepare the students:

To familiarize the important tools Linear Algebra, differential Calculus, Beta and Gamma functions, 3–Dimentional Geometry and probability for analysing the engineering problems.

Module–1	L1,L2	8 Hrs.

Linear Algebra:

Introduction, Rank of a matrix–echelon form. Solution of system of linear equations consistency. Gauss–elimination method and problems. Eigen values and Eigen vectors of square matrix of order two and Problems

Video **Link:**

- https://www.math.ust.hk/~machas/matrix-algebra-for-engineers.pdf
- https://nptel.ac.in/content/storage2/courses/122104018/node18.html

Module–2	L1,L2	8 Hrs.

Differential calculus:

Tangent and normal, both Cartesian and polar forms. Increasing and decreasing functions, Maxima and Minima for a function of one variable. Point of inflections and Problems.

Beta and Gamma functions:

Beta and Gamma functions, Relation between Beta and Gamma function–simple problems.

Video Link

- https://www.youtube.com/watch?v=6RwOoPN2zqE
- https://www.youtube.com/watch?v=s6F5yjY6jWk&list=PLMLsjhQWWlUqBoTCQDtYlloI-o-9hxp11
- http://tutorial.math.lamar.edu/Classes/DE/IntroPDE.aspx

Module–3	L1,L2	8 Hrs.

Analytical solid geometry :

Introduction Directional cosine and Directional ratio of a line, Equation of line in space– different forms, Angle between two line, shortest distance between two line, plane and equation of plane in different forms and problems.

Video Links:

- https://www.toppr.com/guides/maths/three-dimensional-geometry/
- https://www.toppr.com/guides/maths/three-dimensional-geometry/distance-between-skew-lines/

Module-4	L1,L2,L3	8 Hrs.

Probability:

Random variable, Discrete probability distribution, Mean and variance of Random Variable, Theoretical distribution- Binomial distribution, Mean and variance Binomial distribution -Problems. Poisson distribution as a limiting case of Binomial distribution, Mean and variance of Poisson distribution.

Normal Distribution-Basic properties of Normal distribution standard form of normal distribution and Problems

Video Links:

- https://nptel.ac.in/courses/111/105/111105041/
- https://www.mathsisfun.com/data/probability.html

Module-5	L1,L2	8 Hrs.

Partial Differential equation: Formation of PDE's by elimination of arbitrary constants and functions. Solution of non-homogeneous PDE by direct integration. Homogeneous PDEs involving derivative with respect to one independent variable only.

Video Link:

- http://tutorial.math.lamar.edu/Classes/DE/IntroPDE.aspx
- https://www.studyyaar.com/index.php/module-video/watch/233-cauchys-legendres-de-a-method-of- variation-of-parameters

Course Outcomes:

CO1	Apply the knowledge of Matrices to solve the system of linear equations and to understand the concepts of Eigen value and Eigen vectors for engineering problems.
CO2	Demonstrate various physical models ,find Maxima and Minima for a function of one variable., Point of inflections and Problems .Understand Beta and Gamma function
CO3	Understand the 3-Dimensional geometry basic, Equation of line in space- different forms, Angle between two line and studying the shortest distance.
CO4	Concepts of Probability related to engineering applications.
CO5	Construct a variety of partial differential equations and solution by exact methods.

Reference Books:

1.	B.S. Grewal, "Higher Engineering Mathematics" Khanna Publishers, 43rd Edition, 2013.

2.	Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley –India publishers, 10thedition,2014.
3	Ramana B. V., "Higher Engineering Mathematics", Tata Mc Graw –Hill, 2006.
4	G. B. Gururajachar: Calculus and Linear Algebra, Academic Excellent Series Publication, 2018–19

CO–**PO/PSO Mapping**														
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	3	-	-	-	-	-	-	-	1	2	-
CO2	3	2	-	3	-	-	-	-	-	-	-	-	2	-
CO3	3	3	-	2	-	-	-	-	-	-	-	-	2	2
CO4	2	3	-	3	-	-	-	-	-	-	-	1	3	2
CO5	3	3	-	3	-	-	-	-	-	-	-	1	3	3

High–3, Medium–2, Low–1