# VIVEKANAND EDUCATION SOCIETY'S INSTITUTE OF TECHNOLOGY

**(Autonomous Institute Affiliated to University of Mumbai)**


# Master of Computer Applications

## MCA

## Autonomy Syllabus (NEP Scheme)

Effect from the academic year 2024–2025

## First Year MCA Semester I & II

| Year (2 Yr PG) | Level | Sem. | Major | | | | Cum. Cr. | Degree |
|---|---|---|---|---|---|---|---|---|
| | | | Mandatory | | Electives Any one | | | |
| I | 6.0 | Sem I | NMCA11 | 4 | NMCAE1X **(Cr:4)** | | 24 | **PG Diploma in Computer Application (PGDCA)**<br><br>**(After 3 Year Degree)** |
| | | | NMCA12 | 3 | NMCAE11 | 4 | | |
| | | | NMCA13 | 3 | NMCAE12 | 4 | | |
| | | | NMCA14 | 3 | NMCAE13 | 4 | | |
| | | | NMCAL11 | 1 | | | | |
| | | | NMCAL12 | 1 | | | | |
| | | | **N**MCAL13 | 1 | | | | |
| | | | **N**MCAL14 | 1 | | | | |
| | | | **N**MCAL15 | 2 | | | | |
| | | | NMCAFP11(Field Project(OJT/FP) | 1 | | | | |
| | | Sem II | NMCA21 | 4 | NMCAE21X **(Cr: 4)** | | 25 | |
| | | | NMCA22 | 3 | NMCAE211 | 3 | | |
| | | | NMCA23 | 4 | NMCAE212 | 3 | | |
| | | | NMCAL21 | 1 | NMCAE213 | 3 | | |
| | | | NMCAL23 | 1 | NMCALE211 | 1 | | |
| | | | NMCAL24 | 2 | NMCALE212 | 1 | | |
| | | | NMCAL25 | 1 | NMCALE213 | 1 | | |
| | | | NMCAFP21(Field Project (OJT/FP) | 1 | NMCAE22X**(Cr:4)** | | | |
| | | | | | NMCAE221 | 4 | | |
| | | | | | NMCAE222 | 4 | | |
| | | | | | NMCAE223 | 4 | | |
| **Cumulative Credits for PG Diploma** | | | **37** | | **12** | | **49** | |

**Exit option:** PG Diploma 44-52 Credits after Three Year UG Degree (with additional 4 credits of OJT)

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## CURRICULUM SCHEME FOR NEP POSTGRADUATE ACADEMIC PROGRAM AT VESIT

## 2024 : Branch: MCA Semester I

| Type of Course | Course Code | Name of Course | Teaching Scheme (Contact Hours) | | | Credits Assigned | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | Theory | Pract. | Tut. | Theory | Pract. | Tut. | Total |
| Major (Mandatory) | NMCA11 | Statistics for Data Science | 3 | - | 1 | 3 | - | 1 | 4 |
| Major (Mandatory) | NMCA12 | Java for Full Stack Development | 3 | - | - | 3 | - | - | 3 |
| Major (Mandatory) | NMCA13 | Data Warehousing and Mining. | 3 | - | - | 3 | - | - | 3 |
| Major (Mandatory) | NMCA14 | User Experience Design and Development | 3 | - | -- | 3 | - | -- | 3 |
| Major (Elective) | NMCAE1X | Elective - 1 | 3 | - | 1 | 3 | - | 1 | 4 |
| Major (Mandatory) | NMCAL11 | Python Programming Lab | - | 2 | - | - | 1 | - | 1 |
| Major (Mandatory) | NMCAL12 | Java for Full Stack Development Lab | - | 2 | - | - | 1 | - | 1 |
| Major (Mandatory) | NMCAL13 | Data Analytics Lab | - | 2 | - | - | 1 | - | 1 |
| Major (Mandatory) | NMCAL14 | Skill based Lab Course User Interface & User Experience Lab | - | 2 | - | - | 1 | - | 1 |
| Major (Mandatory) | NMCAL15 | Web Application Technologies Lab | 1 | 2 | - | 1 | 1 | - | 2 |
| Field Project (OJT/FP) | NMCAFP11 | Project Seminar (Real Life Problems based on Societal Issues) | - | 2 | - | - | 1 | - | 1 |
| Total | | | 16 | 12 | 2 | 16 | 06 | 2 | 24 |

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| Type of Course | Course Code | Name of Course | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Theory | | | | | Term Work | Pract & oral | Total |
| | | | Internal Assessment | | | End Sem. Exam | Exam. Duration (in Hrs) | | | |
| | | | MT | CA | Tot | | | | | |
| Major (Mandatory) | NMCA11 | Statistics for Data Science | 20 | 20 | 40 | 60 | 2 | 25 | -- | 125 |
| Major (Mandatory) | NMCA12 | Java for Full Stack Development | 20 | 20 | 40 | 60 | 2 | -- | -- | 100 |
| Major (Mandatory) | NMCA13 | Data Warehousing and Mining. | 20 | 20 | 40 | 60 | 2 | -- | -- | 100 |
| Major (Mandatory) | NMCA14 | User Experience Design and Development | 20 | 20 | 40 | 60 | 2 | -- | – | 100 |
| Major (Elective) | NMCAE1X | Elective - 1 | 20 | 20 | 40 | 60 | 2 | 25 | -- | 125 |
| Major (Mandatory) | NMCAL11 | Python Programming LAB | -- | -- | -- | -- | -- | 25 | 50 | 75 |
| Major (Mandatory) | NMCAL12 | Java for Full Stack Development Lab | -- | -- | -- | -- | -- | 25 | 50 | 75 |
| Major (Mandatory) | NMCAL13 | Data Analytics Lab | -- | -- | -- | -- | -- | 25 | 50 | 75 |
| Major (Mandatory) | NMCAL14 | Skill based Lab Course User Interface & User Experience Lab | -- | -- | -- | -- | -- | 25 | 50 | 75 |
| Major (Mandatory) | NMCAL15 | Web Application Technologies Lab | -- | -- | -- | -- | -- | 50 | 50 | 100 |
| Field Project (OJT/FP) | NMCAFP11 | Project Seminar (Real Life Problems based on Societal Issues) | -- | -- | -- | -- | -- | 50 | -- | 50 |
| Total | | | -- | -- | 200 | 300 | -- | 250 | 250 | 1000 |

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## Elective 1

| Sr. No. | Course Code | Name of Course |
|---|---|---|
| 1 | NMCAE11 | Digital Marketing and Business Analytics |
| 2 | NMCAE12 | Agile Project Management |
| 3 | NMCAE13 | Entrepreneurship Management |

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## CURRICULUM SCHEME FOR NEP POSTGRADUATE ACADEMIC PROGRAM AT VESIT

## 2024 : Branch: MCA Semester II

| Type of Course | Course Code | Name of Course | Teaching Scheme (Contact Hours) | | | Credits Assigned | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | Theory | Pract. | Tut. | Theory | Pract. | Tut. | Total |
| Major (Mandatory) | NMCA21 | Combinatorial Algorithms for Problem Solving | 3 | -- | 1 | 3 | -- | 1 | 4 |
| Major (Mandatory) | NMCA22 | Artificial Intelligence and Machine Learning | 3 | -- | -- | 3 | -- | -- | 3 |
| Major (Mandatory) | NMCA23 | Research Methodology | 3 | -- | 1 | 3 | -- | 1 | 4 |
| Major (Elective) | NMCAE21X | Elective - 2 | 3 | -- | -- | 3 | | -- | 3 |
| Major (Elective) | NMCAE22X | Elective - 3 | 3 | -- | 1 | 3 | -- | 1 | 4 |
| Major (Mandatory) | NMCAL21 | Artificial Intelligence and Machine Learning Lab | -- | 2 | -- | -- | 1 | -- | 1 |
| Major (Elective) | NMCALE21X | Elective - 2 Lab | -- | 2 | -- | -- | 1 | -- | 1 |
| Major (Mandatory) | NMCAL23 | Soft Skill Development Lab | -- | 2 | -- | -- | 1 | -- | 1 |
| Major (Mandatory) | NMCAL24 | Skill based Lab Course. DevOps Lab | -- | 4 | -- | -- | 2 | -- | 2 |
| Major (Mandatory) | NMCAL25 | Skill based Lab Course Advanced Data Engineering with Cloud Lab | -- | 2 | -- | -- | 1 | -- | 1 |
| Field Project (OJT/FP) | NMCAFP21 | Project Stage- 1 | -- | 2 | -- | -- | 1 | -- | 1 |
| **Total** | | | **15** | **14** | **3** | **15** | **7** | **3** | **25** |

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## CURRICULUM SCHEME FOR NEP POSTGRADUATE ACADEMIC PROGRAM AT VESIT

## 2024 : Branch: MCA Semester II

| Type of Course | Course Code | Name of Course | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Theory | | | | | Term Work | Pract & oral | Total |
| | | | Internal Assessment | | | End Sem. Exam. | Exam. Duration (in Hrs) | | | |
| | | | MT | CA | Tot. | | | | | |
| Major (Mandatory) | NMCA21 | Combinatorial Algorithms for Problem Solving | 20 | 20 | 40 | 60 | 2 | 25 | -- | 125 |
| Major (Mandatory) | NMCA22 | Artificial Intelligence and Machine Learning | 20 | 20 | 40 | 60 | 2 | -- | -- | 100 |
| Major (Mandatory) | NMCA23 | Research Methodology | 20 | 20 | 40 | 60 | 2 | 25 | -- | 125 |
| Major (Elective) | NMCAE21X | Elective – 2 | 20 | 20 | 40 | 60 | 2 | -- | -- | 100 |
| Major (Elective) | NMCAE22X | Elective – 3 | 20 | 20 | 40 | 60 | 2 | 25 | -- | 125 |
| Major (Mandatory) | NMCAL21 | Artificial Intelligence and Machine Learning Lab | -- | -- | -- | -- | -- | 25 | 50 | 75 |
| Major (Elective) | NMCALE21X | Elective – 2 Lab | -- | -- | -- | -- | -- | 25 | 50 | 75 |
| Major (Mandatory) | NMCAL23 | Soft Skill Development Lab | -- | -- | -- | -- | -- | 50 | -- | 50 |
| Major (Mandatory) | NMCAL24 | Skill based Lab Course. DevOps Lab | -- | -- | -- | -- | -- | 50 | 50 | 100 |
| Major (Mandatory) | NMCAL25 | Skill based Lab Course Advanced Data Engineering with Cloud Lab | -- | -- | -- | -- | -- | 25 | 50 | 75 |
| Field Project (OJT/FP) | NMCAFP21 | Project Stage- 1 | -- | -- | -- | -- | -- | 50 | -- | 50 |
| **Total** | | | **--** | **--** | **200** | **300** | **--** | **300** | **200** | **1000** |

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## Elective 2

| Sr. No. | Course Code | Name of Course | Lab Course Code |
|---|---|---|---|
| 1 | NMCAE211 | Internet of Things & Industrial Internet of Things | NMCALE211 |
| 2 | NMCAE212 | Design and Analysis of Algorithm | NMCALE212 |
| 3 | NMCAE213 | Software Testing & Quality Assurance | NMCALE213 |

## Elective 3

| Sr. No. | Course Code | Name of Course |
|---|---|---|
| 1 | NMCAE221 | Cyber Security and Laws |
| 2 | NMCAE222 | Design Thinking |
| 3 | NMCAE223 | Risk Analysis Management |

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## CURRICULUM SCHEME FOR NEP POSTGRADUATE ACADEMIC PROGRAM AT VESIT

## 2024 : Branch: MCA Bridge Course

For the graduates, not having graduation in Computer Science/Information Technology/ Computer Application, need to complete the bridge course along with the MCA regular course

| Course Code | Name of Course | Group | Teaching Scheme (Contact Hours) | | | Credits Assigned | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | Theory | Pract. | Tut. | Theory | Pract. | Tut | Total |
| NMCABR1 | Object Oriented Programming Methodology with Java | ICT | NPTEL/ Udemy Course# | 2 | | -- | -- | -- | --- |
| NMCABR2 | 1.Data Structure with Java<br>2.SQL/PLSQL | ICT | NPTEL/ Udemy Course# | 2 | | -- | -- | -- | -- |
| | Total | | | 04 | -- | -- | -- | -- | -- |

| Course Code | Name of Course | Group | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Theory | | | | | Pract | | |
| | | | Internal Assessment | | | End Sem. | Exam. Duration | Pract | Oral | Total |
| | | | CA | MT | Tot. | | In Hrs | | | |
| NMCABR1 | Object Oriented Programming Methodology with Java | ICT | Assessment will be according to the NPTEL/Udemy Course weighted for 60 Marks and Performance in Laboratory work. | | | | | 40 | – | 100 |
| NMCABR2 | 1.Data Structure with Java<br>2.SQL/PLSQL | ICT | Assessment will be according to the NPTEL/Udemy Course weighted for 60 Marks and Performance in Laboratory work. | | | | | 40 | – | 100 |
| | Total | | | | | | | | | 200 |

**#Course will be Suggested By the Subject Teachers**

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# Master of Computer Applications

# Academic Year 2024-25

**CURRICULUM SCHEME FOR NEP POSTGRADUATE ACADEMIC PROGRAM AT VESIT**

**2024 : Branch: MCA Semester I**

# Semester I

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## CURRICULUM SCHEME FOR NEP POSTGRADUATE ACADEMIC PROGRAM AT VESIT

## 2024 : Branch: MCA Semester I

| Semester I Scheme | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Type of Course | Course Code | Name of Course | Teaching Scheme (Contact Hours) | | | Credits Assigned | | | |
| | | | Theory | Pract. | Tut. | Theory | Pract. | Tut. | Total |
| Major (Mandatory) | NMCA11 | Statistics for Data Science | 3 | - - | 1 | 3 | - | 1 | 4 |
| Major (Mandatory) | NMCA12 | Java for Full Stack Development | 3 | - - | -- | 3 | -- | -- | 3 |
| Major (Mandatory) | NMCA13 | Data Warehousing and Mining. | 3 | - - | -- | 3 | -- | -- | 3 |
| Major (Mandatory) | NMCA14 | User Experience Design and Development | 3 | – | -- | 3 | – | - - | 3 |
| Major (Elective) | NMCAE1X | Elective - 1 | 3 | - | 1 | 3 | - | 1 | 4 |
| Major (Mandatory) | NMCAL11 | Python Programming Lab | -- | 2 | -- | -- | 1 | -- | 1 |
| Major (Mandatory) | NMCAL12 | Java for Full Stack Development Lab | -- | 2 | -- | -- | 1 | -- | 1 |
| Major (Mandatory) | NMCAL13 | Data Analytics Lab | -- | 2 | -- | -- | 1 | -- | 1 |
| Major (Mandatory) | NMCAL14 | Skill based Lab: User Interface & User Experience Lab | -- | 2 | -- | -- | 1 | -- | 1 |
| Major (Mandatory) | NMCAL15 | Web Application Technologies Lab | 1 | 2 | - | 1 | 1 | - | 2 |
| Field Project (OJT/FP) | NMCAFP11 | Project Seminar (Real Life Problems based on Societal Issues) | -- | 2 | -- | -- | 1 | -- | 1 |
| Total | | | 16 | 12 | 2 | 16 | 06 | 2 | 24 |

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| Type of Course | Course Code | Name of Course | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Theory | | | | | Term Work | Pract & oral | Total |
| | | | Internal Assessment | | | End Sem. Exam | Exam. Duration (in Hrs) | | | |
| | | | MT | CA | Tot | | | | | |
| Major (Mandatory) | NMCA11 | Statistics for Data Science | 20 | 20 | 40 | 60 | 2 | 25 | -- | 125 |
| Major (Mandatory) | NMCA12 | Java for Full Stack Development | 20 | 20 | 40 | 60 | 2 | -- | -- | 100 |
| Major (Mandatory) | NMCA13 | Data Warehousing and Mining. | 20 | 20 | 40 | 60 | 2 | -- | -- | 100 |
| Major (Mandatory) | NMCA14 | User Experience Design and Development | 20 | 20 | 40 | 60 | 2 | -- | – | 100 |
| Major (Elective) | NMCAE1X | Elective - 1 | 20 | 20 | 40 | 60 | 2 | 25 | -- | 125 |
| Major (Mandatory) | NMCAL11 | Python Programming Lab | -- | -- | -- | -- | -- | 25 | 50 | 75 |
| Major (Mandatory) | NMCAL12 | Java for Full Stack Development Lab | -- | -- | -- | -- | -- | 25 | 50 | 75 |
| Major (Mandatory) | NMCAL13 | Data Analytics Lab | -- | -- | -- | -- | -- | 25 | 50 | 75 |
| Major (Mandatory) | NMCAL14 | Skill based Lab Course User Interface & User Experience Lab | -- | -- | -- | -- | -- | 25 | 50 | 75 |
| Major (Mandatory) | NMCAL15 | Web Application Technologies Lab | -- | -- | -- | -- | -- | 50 | 50 | 100 |
| Field Project (OJT/FP) | NMCAFP11 | Project Seminar (Real Life Problems based on Societal Issues) | -- | -- | -- | -- | -- | 50 | -- | 50 |
| Total | | | -- | -- | 200 | 300 | -- | 250 | 275 | 1000 |

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## Elective 1

| Sr. No. | Course Code | Name of Course |
|---|---|---|
| 1 | NMCAE11 | Digital Marketing and Business Analytics |
| 2 | NMCAE12 | Agile Project Management |
| 3 | NMCAE13 | Entrepreneurship Management |

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## Semester I

| Course Code | Name of Course | Teaching Scheme | | | Credits Assigned | | |
|---|---|---|---|---|---|---|---|
| NMCA11 | Statistics for Data Science | Contact Hours | | | | | |
| | | Theory | | Tutorial | Theory | Tutorial | Total |
| | | 3 | | 1 | 3 | 1 | 4 |
| | | Examination Scheme | | | | | |
| | | Theory | | | Term Work | End Sem Exam | Total |
| | | CA | MT | Total | | | |
| | | 20 | 20 | 40 | 25 | 60 | 125 |

**Prerequisite:** Student must know

1. Set theory
2. Basic principles of counting

**Course Objectives:** Course is aim to

| Sr.No. | Course Objective |
|---|---|
| 1 | Statistical measures on various types of data |
| 2 | Correlation and regression techniques for estimation |
| 3 | Probability aspects to take proper decision |
| 4 | Application of discrete and continuous probability distributions |
| 5 | Various methods of hypothesis testing |
| 6 | Understand different ways to calculate probability. |

**Course Outcomes:** On successful completion of the course learner/ student will be able to

| Sr.No. | Outcome | Bloom Level |
|---|---|---|
| CO1 | Apply different statistical measures to various types of data | Applying |
| CO2 | Evaluate using regression analysis | Evaluating |
| CO3 | Analyze different types of probability and their fundamental Applications. | Analyzing |
| CO4 | Apply probability distribution to real world problems | Applying |
| CO5 | Formulate and test the hypothesis for business problem using various methods | Creating |
| CO6 | Evaluate probability distribution using random variables. | Evaluating |

| Module | Detailed Contents | Hrs |
|---|---|---|
| 1 | **Measures of Central Tendency & Measures of Dispersion:** Frequency Distribution, Histogram, Stem and leaf diagram, ogives, Box whisker plot, Frequency Polygon, Mean, Median, Mode, Range, Quartile Deviation, Standard Deviation, and Coefficient of Variation.<br><br>**Self-Learning Topics:** Basics of variance, Basic principles of counting. | 5 |
| 2 | **Skewness, Regression, and correlation:** Skewness: Karl Pearson's coefficient of skewness, Bowley's coefficient of skewness.<br>Correlation: Karl Pearson's coefficient of correlation, Spearman's rank correlation coefficient.<br>Regression: Linear and Non-linear regression (quadratic), Estimation using linear regression.<br><br>**Self-Learning Topics:** Apply correlation and regression on real world data and its graphical representation. | 8 |
| 3 | **Introduction to probability & conditional probability:** Introduction to probability, Random experiment, Sample space, Events, Axiomatic Probability, Algebra of events. Conditional Probability, Multiplication theorem of Probability, Independent events, Bayes' Theorem.<br><br>**Self-Learning Topics:** Applications based on Bayes' theorem. | 8 |
| 4 | **Random variable:** Discrete random variable, Continuous random variable, Two-dimensional random variable, Joint probability distribution, Stochastic independence, Properties of Expectation and Variance, Covariance.<br><br>**Self-Learning Topics:** Study of various random variables and its independence. | 8 |
| 5 | **Theoretical probability distributions:** Binomial, Poisson, Normal.<br><br>**Self-Learning Topics:** Study of properties of standard normal variate. | 5 |
| 6 | **Sampling & Testing of hypothesis:** Sampling: Probability Sampling, Non- Probability Sampling<br>Hypothesis testing, Type I and Type II errors.<br>Tests of significance – single sample, Student's t-test, large sample test (z-test).<br><br>**Self-Learning Topics:** Study of elementary sampling methods | 5 |

**Reference Books**:

| Reference No | Reference Name |
|---|---|
| **1** | S.C.Gupta, V.K.Kapoor, S Chand, Fundamentals of Mathematical Statistics, Sultan and Chand sons publication, First Edition |
| **2** | Hwei P. Hsu, Schaum's Outlines Probability, Random Variables & Random Process, Tata McGraw Hill, Third Edition |
| **3** | J.Susan Milton, Jesse C. Arnold, Introduction to Probability & Statistics, Tata McGraw Hill, Fourth Edition |
| **4** | Dr J Ravichandran, Probability & Statistics for Engineers, Wiley |
| **5** | Dr Seema Sharma, Statistics for Business and Economics, Wiley |
| **6** | Ken Black, Applied Business Statistics, Wiley, Seventh Edition |

**Web References:**

| Reference No | Reference Name |
|---|---|
| 1 | IIT Kharagpur – Probability and Statistics by Dr. Somesh Kumar https://nptel.ac.in/courses/111105041/ |
| 2 | IIT Madras – Introduction to Probability and Statistics by Dr. G. Srinivasan https://nptel.ac.in/courses/111/106/111106112/ |
| 3 | IIT Kanpur – Descriptive Statistics with R Software by Prof. Shalabh https://nptel.ac.in/courses/111/104/111104120/ |
| 4 | IIT Roorkee – Business Statistics by Prof. Mukesh Kumar Barua https://nptel.ac.in/courses/110/107/110107114/ |
| 5 | MIT – Introduction to Probability and statistics by Jeremy Orloff and Jonathan Bloom https://ocw.mit.edu/courses/mathematics/18-05-introduction-to-probability-and-statistics-spring-2014/index.htm |
| 6 | An Introduction to Statistical Learning with Applications in R by Gareth James, Daniela Witten, Trevor Hastie and Robert Tibshirani http://faculty.marshall.usc.edu/gareth-james/ISL/data.html |

**Tutorials:**

| Sr No | Topic | Hours |
|---|---|---|
| 1 | Find Bowley's & Karl Pearson's coefficient of skewness | 1 |
| 2 | Calculate Karl Pearson's and Spearman's coefficient of correlation | 1 |
| 3 | To fit linear regression and estimate | 1 |
| 4 | Examples on addition and multiplication theorem of probability | 1 |
| 5 | Examples based on Bayes' theorem | 1 |
| 6 | Examples based on independence of discrete random variables. | 1 |
| 7 | Examples based on independence of continuous random variables. | 1 |

| | | |
|---|---|---|
| 8 | Example on Poisson distribution | 1 |
| 9 | Example on normal distribution | 1 |
| 10 | Example on t-test | 1 |

**Internal Assessment:**
Assessment consists of one Mid Term Test of 20 marks and Continuous Assessment of 20 marks. Mid Term test is to be conducted when approx. 50% syllabus is completed Duration of the midterm test shall be one hour.

**Continuous Assessment: -**
Continuous Assessment is of 20 marks. The rubrics for assessment will be considered on approval by the subject teachers. The rubrics can be any 2 or max 4 of the following: -

| Sr.no | Rubrics | Marks |
|---|---|---|
| 1. | *Certificate course for 4 weeks or more: - NPTEL/ Coursera/ Udemy/any MOOC | 10 marks |
| 2. | Wins in the event/competition/hackathon | 10 marks |
| 3. | Content beyond syllabus presentation | 10 marks |
| 4. | Creating Proof of concept | 10 marks |
| 5. | Mini Project / Extra Experiments/ Virtual Lab | 10 marks |
| 6. | Assignment/Tutorials Based on Syllabus | 10 marks |
| 7. | Participation in event/workshop/talk / competition followed by small report and certificate of participation relevant to the subject(in other institutes) | 5 marks |
| 8. | Multiple Choice Questions (Quiz) | 5 marks |

| **End Semester Theory Examination:** | |
|---|---|
| 1 | Question paper will be of 60 marks |
| 2 | Question paper will have a total of five questions |
| 3 | All questions have equal weightage and carry 20 marks each |
| 4 | Any three questions out of five need to be solved. |

**Term Work: 25 marks**
The term work will be based on Tutorial Performance.

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| Course Code | Course Name | Teaching Scheme | | | Credits Assigned | | |
|---|---|---|---|---|---|---|---|
| NMCA12 | Java for Full Stack Development | Contact Hours | | | | | |
| | | Theory | | Tutorial | Theory | Tutorial | Total |
| | | 3 | | -- | 3 | -- | 3 |
| | | Examination Scheme | | | | | |
| | | Theory | | | Term Work | End Sem Exam | Total |
| | | CA | MT | Total | | | |
| | | 20 | 20 | 40 | -- | 60 | 100 |

**Prerequisite:**

1. Basic understanding of any Object-Oriented Programming Language
2. Successfully completed Programming Concepts of Core Java course

**Course Objectives:** Course is aim to

| Sr.No. | Course Objective |
|---|---|
| 1 | Learn the basic data structure operation using Java Collection Framework and understand Lambda expressions. |
| 2 | Build web applications using JSP and JSTL. |
| 3 | Understand Spring Framework and build Java EE applications and services. |
| 4 | Apply Data Access using Spring Framework |
| 5 | Understand how to simplify Spring applications using Spring Boot |
| 6 | Understanding Spring Boot RESTful Web Services. |

**Course Outcomes:** On successful completion of the course learner/student will be able to

| Sr.No. | Outcome | Bloom Level |
|---|---|---|
| CO1 | Demonstrate use of data structure and data manipulation concept using Java Collection Framework and Lambda expressions. | Applying |
| CO2 | Create JSP using standard actions, custom tags, Introduction to JSP Standard Tag Library (JSTL) and JSTL Tags. | Creating |
| CO3 | Understand and develop applications using Spring Framework, Lightweight Container and Dependency Injection with Spring. | Creating |
| CO4 | Develop applications using Aspect Oriented Programming with Spring. | Creating |
| CO5 | Apply JDBC Data Access with Spring and demonstrate Data access operations with JDBC Template and Spring. | Applying |

| | | |
|---|---|---|
| **CO6** | Create Spring Boot Web Application and Spring Boot RESTful WebServices. | Applying |

| Module | Detailed Contents | Hrs |
|---|---|---|
| **01** | **Introduction Java EE Programming**<br>JSP Architecture, JSP building blocks, Scripting Tags, implicit object, Introduction to Bean, standard actions, session tracking types and methods. Custom Tags, Introduction to JSP Standard Tag Library (JSTL) and JSTL Tags.<br><br>**Self-learning topics** Simple Application using Servlet. | **8** |
| **02** | **Spring Frameworks:**<br>Introduction to Spring Framework,POJO Programming Model, Lightweight Containers (Spring IOC container, Configuration Meta Data, Configuring and using the Container) Dependency Injection with Spring- Setter Injection, Constructor Injection, Circular Dependency, Overriding Bean, Auto Wiring Bean Lookup, Spring Manage Beans).<br>**Self-learning topics** Bean Definition Profiles. | **6** |
| **03** | **Spring and AOP**<br>Aspect Oriented Programming with Spring, Types of advice, Defining PointCut Designator, Annotations.<br>**Self-learning topics** AspectJ. | **5** |
| **04** | **JDBC Data Access with Spring**<br>Managing JDBC Connection, Configuring Data Source to obtain JDBC Connection, Data Access operations with JDBCTemplate and Spring, RDBMS operation classes, Modelling JDBC Operations as Java Objects.<br>**Self-learning topics** JDBC Architecture and basic JDBC Program using DML operation | **6** |
| **05** | **Getting Started with Spring Boot**<br>Introduction, Spring Boot and Database, Introduction to exception handling in spring boot.<br><br>**Self-learning topics** Spring Boot Web Application Development, Understanding Transaction Management in Spring. | **5** |
| **06** | **ReactJS**<br>Introduction to reactjs, understanding JSX, React components, component lifecycle, react class, introduction to react State and Props, react event, react conditionals, react list and forms, hook.<br>**Self-learning topics** Model-ViewController framework, Flux, | **9** |

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**Reference Books**:

| Reference No | Reference Name |
|---|---|
| 1 | Java 6 Programming Black Book, Wiley–Dreamtech ISBN 10: 817722736X ISBN 13: 9788177227369 |
| 2 | Web Enabled Commercial Application Development using java 2.0, Ivan Byaross ISBN-10: 8176563560 / ISBN-13: 978-8176563567 |
| 3 | Java Server Programming java EE6, Black book, Dreamtech Press. ISBN-10: 8177229362 / ISBN-13: 978-8177229363 |
| 4 | Core Servlets and Java Server Pages: Vol I: Core Technologies 2/e , Marty Hall and Larry Brown, Pearson , ISBN: 9788131701638, 8131701638 |
| 5 | Java Enterprise in a Nutshell, 3rd Edition A Practical Guide, Jim Farley, William Crawford,O'Reilly ISBN-13: 978-0596101428 / ISBN-10: 0596101422 |
| 6 | Java EE 6 Server Programming For Professionals, Sharanam Shah and Vaishali Shah, SPD, ISBN-10: 9788184049411 / ISBN-13: 978-8184049411 |
| 7 | Spring in Action, Craig Walls, 3rd Edition,Manning, ISBN 9781935182351 |
| 8 | **Professional Java Development with the Spring Framework** by Rod Johnsonet al.John Wiley & Sons 2005 (672 pages) ISBN:0764574833 |
| 9 | Beginning Spring , Mert Calıs kan and KenanSevindik Published by John Wiley & Sons, Inc. 10475 Crosspoint Boulevard Indianapolis, IN 46256 www.wiley.com |

**Web References:**

| Reference No | Reference Name |
|---|---|
| 1 | https://docs.oracle.com |
| 2 | Spring.io |

**Internal Assessment:**

Assessment consists of one Mid Term Test of 20 marks and Continuous Assessment of 20 marks.
Mid Term test is to be conducted when approx. 50% syllabus is completed Duration of the midterm test shall be one hour.

**Continuous Assessment: -**

Continuous Assessment is of 20 marks. The rubrics for assessment will be considered on approval by the subject teachers. The rubrics can be any 2 or max 4 of the following: -

| Sr.no | Rubrics | Marks |
|---|---|---|
| 1. | *Certificate course for 4 weeks or more:-NPTEL/ Coursera/ Udemy/any MOOC | 10 marks |
| 2. | Wins in the event/competition/hackathon | 10 marks |
| 3. | Content beyond syllabus presentation | 10 marks |
| 4. | Creating Proof of concept | 10 marks |

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| | | |
|---|---|---|
| 5. | Mini Project / Extra Experiments/ Virtual Lab | 10 marks |
| 6. | Assignment/Tutorials Based on Syllabus | 10 marks |
| 7. | Participation in event/workshop/talk / competition followed by small report and certificate of participation relevant to the subject (in other institutes) | 5 marks |
| 8. | Multiple Choice Questions (Quiz) | 5 marks |

| **End Semester Theory Examination:** | |
|---|---|
| 1 | Question paper will be of 60 marks |
| 2 | Question paper will have a total of five questions |
| 3 | All questions have equal weightage and carry 20 marks each |
| 4 | Any three questions out of five need to be solved. |

# Vivekanand Education Society's

# Institute of Technology

(An Autonomous Institute Affiliated to University of Mumbai)

| Course Code | Name of Course | Teaching Scheme | | | Credits Assigned | | |
|---|---|---|---|---|---|---|---|
| NMCA13 | Data Warehousing and Mining | Contact Hours | | | | | |
| | | Theory | | Tutorial | Theory | Tutorial | Total |
| | | 3 | | -- | 3 | -- | 3 |
| | | Examination Scheme | | | | | |
| | | Theory | | | Term Work | End Sem Exam | Total |
| | | CA | MT | Total | | | |
| | | 20 | 20 | 40 | -- | 60 | 100 |

**Prerequisite:** Database Management System

**Course Objectives: Course is aim to**

| Sr. No. | Course Objective |
|---|---|
| 1 | To understand the concepts of data warehouse architecture , ETL process, and OLAP functions. |
| 2 | To acquire the knowledge of data analytics and apply them to real world scenarios. |
| 3 | To demonstrate the importance of the various data pre-processing techniques and applications. |
| 4 | To analyze the data and generate the association rules for real world problems. |
| 5 | To acquire the knowledge of classification algorithms and apply them to real world problems. |
| 6 | To demonstrate the various clustering algorithms and apply them to real world scenarios. |

**Course Outcomes:**

| Sr. No. | Outcome | Bloom Level |
|---|---|---|
| CO1 | Model the data warehouse with the ETL process and perform dimensional modeling and data analysis using OLAP operations. | Understanding |
| CO2 | Apply various types of analytics to get data insights. | Applying |
| CO3 | Apply various Data preprocessing and Data reduction techniques. | Applying |
| CO4 | Discover associations among items using association rule mining. | Analyzing |
| CO5 | Classify data using various Classification Algorithms to support decision making. | Evaluating |
| CO6 | Apply various Clustering Algorithms to make informed decisions. | Evaluating |

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| Module | Detailed Contents | Hrs |
|---|---|---|
| 01 | **Data Warehousing and OLAP:**<br>Data warehouse: Introduction to DW, DW architecture, ETL process, Top- down and bottom-up approaches, characteristics, and benefits of data mart.<br>Dimensional Modeling: Star, Snowflake, and Fact Constellation Schemas, major features and functions of OLAP, OLAP models- ROLAP and MOLAP, and the difference between OLAP and OLTP.<br><br>**Self-Learning Topics**: Study any one DW implementation. | **08** |
| 02 | **Data Analytics:**<br>Data Analytics Overview, Importance of Data Analytics, Types of Data Analytics, Descriptive Analytics, Diagnostic Analytics, Predictive Analytics, Prescriptive Analytics, Benefits of Data Analytics, and Data Visualization Techniques.<br><br>**Self-Learning Topics**: Case Studies of Data analytics. | **06** |
| 03 | **Module: Data Pre-processing:**<br>Introduction to data mining, knowledge discovery- KDD process.<br>Data Preprocessing: Types of Attributes; Data Cleaning - Missing Values; Noisy Data; Data Integration and Transformations.<br>Data Reduction - Data cube aggregation, dimensionality reduction, data compression, numerosity reduction, discretization, and concept hierarchy .Binning<br><br>**Self-Learning Topics**: Data normalization. | **07** |
| 04 | **Data Mining Algorithm- Association Rules:**<br>Association rule mining: support and confidence, Lift, frequent item sets, Market Basket Analysis, the Apriori algorithm, associative classification, and classification- Rule mining.<br><br>**Self-Learning Topics**: Evaluation Metrics. | **06** |
| 05 | **Data Mining Algorithm-Classification:**<br>Classification methods: Statistical-based algorithms- Linear Regression, Naïve Bayesian classification, K-Nearest Neighbor, Decision Tree Algorithms -ID3, C4.5, and CART, Rule-Based Classification, Evaluating Metrics for Classification.<br><br>**Self-Learning Topics**: Case-Based Reasoning. | **07** |
| 06 | **Module: Data Mining Algorithm-Clustering:**<br>Clustering Methods: Partitioning methods - K-Means, K-median, Hierarchical- Agglomerative and Divisive Methods, Model-Based Cluster Analysis, Clustering Metrics. | **05** |

| | | |
|---|---|---|
| | **Self-Learning Topics**: Expectation Maximization Clustering Algorithm. | |

## Reference Books:


| Reference No | Reference Name |
|---|---|
| 1 | Han, Jiawei, Jian Pei, and Micheline Kamber, Data mining: concepts and Techniques, Second Edition, Elsevier, Morgan Kaufmann, 2011. |
| 2 | Ponniah Paulraj, Data warehousing fundamentals: a comprehensive guide for IT professionals, John Wiley & Sons, 2004. |
| 3 | Dunham, Margaret H, Data mining: Introductory and advanced topics, Pearson Education India, 2006. |
| 4 | Gupta, Gopal K, Introduction to data mining with case studies, PHI Learning Pvt. Ltd., 2014. |
| 5 | Ramakrishnan, Raghu, Johannes Gehrke, and Johannes Gehrke, Database management systems, Vol. 3, McGraw-Hill, 2003. |
| 6 | Elmasri, Ramez, and Shamkant B. Navathe, Fundamentals of Database Systems, Pearson Education, 2008, (2015). |
| 7 | Silberschatz, Abraham, Henry F. Korth, and Shashank Sudarshan, Database system concepts, Vol. 5, McGraw-Hill, 1997. |
| 8. | Data Analytics Made Accessible by Dr. Anil Maheshwari |


## Web References:


| Reference No | Reference Name |
|---|---|
| 1 | https://www.guru99.com/data-mining-vs-datawarehouse.html |
| 2 | https://www.tutorialspoint.com/dwh/dwh_overview |
| 3 | https://www.geeksforgeeks.org/ |
| 4 | https://blog.eduonix.com/internet-of-things/web-mining-text-mining-depth-mining-guide/ |

# Vivekanand Education Society's

# Institute of Technology

(An Autonomous Institute Affiliated to University of Mumbai)

**Internal Assessment:**

Assessment consists of one Mid Term Test of 20 marks and Continuous Assessment of 20 marks.
Mid Term test is to be conducted when approx. 50% syllabus is completed Duration of the midterm test shall be one hour.

**Continuous Assessment: -**

Continuous Assessment is of 20 marks. The rubrics for assessment will be considered on approval by the subject teachers. The rubrics can be any 2 or max 4 of the following: -

| Sr.no | Rubrics | Marks |
|---|---|---|
| 1. | *Certificate course for 4 weeks or more: -NPTEL/ Coursera/ Udemy/any MOOC | 10 marks |
| 2. | Wins in the event/competition/hackathon | 10 marks |
| 3. | Content beyond syllabus presentation | 10 marks |
| 4. | Creating Proof of concept | 10 marks |
| 5. | Mini Project / Extra Experiments/ Virtual Lab | 10 marks |
| 6. | Assignment/Tutorials Based on Syllabus | 10 marks |
| 7. | Participation in event/workshop/talk / competition followed by small report and certificate of participation relevant to the subject (in other institutes) | 5 marks |
| 8. | Multiple Choice Questions (Quiz) | 5 marks |

| **End Semester Theory Examination:** | |
|---|---|
| 1 | Question paper will be of 60 marks |
| 2 | Question paper will have a total of five questions |
| 3 | All questions have equal weightage and carry 20 marks each |
| 4 | Any three questions out of five need to be solved. |

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# Vivekanand Education Society's

# Institute of Technology

(An Autonomous Institute Affiliated to University of Mumbai)

| Course Code | Name of Course | Teaching Scheme | | Credits Assigned | | |
|---|---|---|---|---|---|---|
| NMCA14 | User Experience Design and Development | Contact Hours | | | | |
| | | Theory | Tutorial | Theory | Tutorial | Total |
| | | 3 | — | 3 | —- | 3 |
| | | Examination Scheme | | | | |
| | | Theory | | Term Work | End Sem Exam | Total |
| | | CA | Test | Total | | |
| | | 20 | 20 | 40 | — | 60 | 100 |

**Prerequisite:** Knowledge of Software Engineering and its Concepts

**Course Objectives: course aim to**

| Sr.No. | Course Objective |
|---|---|
| 01 | Understand the concepts of Software Engineering process Model and Agile development |
| 02 | Understand the User Experience and Usability |
| 03 | Gain an understanding of user experience design life cycle |
| 04 | Understand and familiarize the Process of Interaction Design |
| 05 | Understand and familiarize Design thinking, Design perspectives, User personas and Ideation |
| 06 | To learn Evaluation and Usability Testing Techniques and Models |

**Course Outcomes:** On successful completion of course learner/student will be able to

| Sr.No. | Course Outcome | Bloom Level |
|---|---|---|
| CO1 | Demonstrate Software development Process Model in the designing and concept of Agility | Understanding |
| CO2 | Be able to Understand the concept of Usability and user experience in design . | Understanding |
| CO3 | Assess the possibilities for user experience design life cycle. | Applying |
| CO4 | Be able to design applications and services that are user-centered. | Applying |
| CO5 | Demonstrate the ability to understand Design thinking, Design perspectives, User personas and Ideation | Understanding |
| CO6 | Demonstrate the ability to evaluate the User Experiences Interface Design | Evaluating |

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| Module | Detailed Contents | Hrs |
|---|---|---|
| 01 | **Software Engineering and Software Development Process Model-**<br>Software, types of software engineering, evolving role of software, challenges in software development.<br>**Module: Agile Development-**<br>Introduction, Basics of agile SE method , drawbacks of agile SE method from the UX perspective, What is Agility? 12 Agile principles, Agility and the cost of change, what is an agile process? Extreme programming, Scrum, Scrum Life cycle and Agile Scrum Framework.<br>**Self-Learning Topics: -**Incremental Process model: Iterative approach, RAD model,UML. | 04 |
| 02 | **Introduction to UX Design**<br>What is UX, Ubiquitous interaction, Emerging desire for usability, From usability to user experience, Emotional impact as part of the user experience, User experience needs a business case, Roots of usability.<br>**Self-Learning Topics: -**.Task Analysis, Psychology and Cognitive science | 07 |
| 03 | **The UX Design - life cycle**<br>Introduction, A UX process lifecycle template, Choosing a process instance for your project, The system complexity space, Meet the user interface team, Scope of UX presence within the team.<br>**Self-Learning Topics: -** More about UX lifecycles. | 07 |
| 04 | **The UX Design Process –Understand Users**<br>Introduction, The system concept statement, User work activity gathering, Look for emotional aspects of work practice, Abridged contextual inquiry process, Data-driven vs. model-driven inquiry, History. , Contextual Analysis, Extracting Interaction Design Requirements, Constructing Design-Information Models.<br>**Self-Learning Topics:** Data Analysis, Interpretation and Presentation. | 08 |
| 05 | **The UX Design Process- : Design thinking,ideation, mental model**<br>Introduction, Design paradigms, Design thinking, Design perspectives, User personas, Ideation, Sketching, More about phenomenology, Mental Models and Conceptual Design, Wireframe, Prototyping<br>**Self-Learning Topics:** Social Interaction, Emotional Interaction. | 06 |
| 06 | **The UX Design Process : UX Evaluation and Improve**<br>UX Goals, Metrics and Targets, UX Evaluation Techniques.- Formative vs summative ,types of formative and informal summative evaluation methods, types of evaluation data, some data collection techniques, variations in formative evaluation results, informal summative data analysis, formative data analysis , feedback to process ,evaluation report<br><br>**Self-Learning Topics:** Predictive Models. | 07 |

**Reference Books**:

| Reference No. | Reference Name |
|---|---|
| 1 | Software Engineering 3rd edition by KK Agrawal, Yogesh Singh, New Age International publication. |
| 2 | Interaction Design Beyond Human-Computer Interaction , Sharp Rogers , 2nd edition , Wiley |
| 3 | Software Engineering, 7th Edition, "Roger S Pressman", TMH |
| 4 | Rex Hartson and Pardha S Pyla, The UX Book, Morgan Kaufmann 978-0123852410 |

**Web References:**

| Reference No. | Reference Name |
|---|---|
| 1 | https://www.tutorialspoint.com |
| 2 | https://technologyadvice.com |
| 3 | https://archive.nptel.ac.in/courses/107/103/107103083/ |

**Internal Assessment:**

Assessment consists of one Mid Term Test of 20 marks and Continuous Assessment of 20 marks.Mid Term test is to be conducted when approx. 50% syllabus is completed Duration of the midterm test shall be one hour.

**Continuous Assessment:**

Continuous Assessment is of 20 marks. The rubrics for assessment will be considered on approval by the subject teachers. The rubrics can be any 2 or max 4 of the following: -

| Sr.no | Rubrics | Marks |
|---|---|---|
| 1. | *Certificate course for 4 weeks or more: - NPTEL/ Coursera/ Udemy/any MOOC | 10 marks |
| 2. | Wins in the event/competition/hackathon | 10 marks |
| 3. | Content beyond syllabus presentation | 10 marks |
| 4. | Creating Proof of concept | 10 marks |
| 5. | Mini Project / Extra Experiments/ Virtual Lab | 10 marks |
| 6. | Assignment/Tutorials Based on Syllabus | 10 marks |

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| | | |
|---|---|---|
| 7. | Participation in event/workshop/talk / competition followed by small report and certificate of participation relevant to the subject (in other institutes) | 5 marks |
| 8. | Multiple Choice Questions (Quiz) | 5 marks |

| **End Semester Theory Examination:** | |
|---|---|
| 1 | Question paper will be of 60 marks |
| 2 | Question paper will have a total of five questions |
| 3 | All questions have equal weightage and carry 20 marks each |
| 4 | Any three questions out of five need to be solved. |

# Vivekanand Education Society's

# Institute of Technology

(An Autonomous Institute Affiliated to University of Mumbai)

| Course Code-E1 | Course Name | Teaching Scheme | | | Credits Assigned | | |
|---|---|---|---|---|---|---|---|
| NMCAE11 | Digital Marketing and Business Analytics | Contact Hours | | | | | |
| | | Theory | | Tutorial | Theory | Tutorial | Total |
| | | 3 | | 1 | 3 | 1 | 4 |
| | | Examination Scheme | | | | | |
| | | Theory | | | Term Work | End Sem Exam | Total |
| | | CA | MT | Total | | | |
| | | 20 | 20 | 40 | 25 | 60 | 125 |

**Prerequisite:** Knowledge about designing tools and basics of marketing

**Course Objectives:** Course is aim to

| Sr.No. | Course Objective |
|---|---|
| 01 | Examine and explore the role and importance of Digital Marketing in the current business scenario. |
| 02 | Familiarize yourself with the various Digital Marketing Tools. |
| 03 | Apply Digital Marketing tools for formulating a Digital Marketing Strategy. |
| 04 | Understand Digital Marketing Campaigns using various Tools and measure their Effectiveness. |
| 05 | Understand the various aspects of Social Marketing |
| 06 | Familiarize with Digital Analytics and its impact in Marketing |

# Vivekanand Education Society's

# Institute of Technology

(An Autonomous Institute Affiliated to University of Mumbai)

**Course Outcomes**: On successful completion of course learner/student will be able to

| Sr.No. | Course Outcome | Bloom Level |
|---|---|---|
| CO1 | Understand the role of Digital Marketing | Remembering |
| CO2 | Demonstrate use of various Digital Marketing Tools. | Understanding |
| CO3 | Discuss key elements of Digital Marketing Strategy. | Applying |
| CO4 | Understand use of Digital Marketing Tools for Digital Marketing Campaigns | Analyzing |
| CO5 | Assess / Measure the effectiveness of the Digital Marketing Campaigns. | Evaluating |
| CO6 | Demonstrate practical skills using common digital marketing tools Like SEO, SEM, and Content Marketing… | Creating |

| Module No. | Detailed Contents | Hrs. |
|---|---|---|
| 1 | Fundamentals of Digital Marketing:<br>Origin and development of Digital Marketing. Digital Marketing Strategy. Skills Required in Digital Marketing, Digital Marketing Plan,<br>Digital Marketing: Display Advertising<br>Introduction to Display Advertising, Types of Display Ads, What Makes a Good Ad? Buying Models, Display Plan, Challenges Faced by Display Advertising.<br><br>**Self Learning Topics:** Programmatic Digital Advertising, YouTube Advertising | 04 |
| 2 | Search Engine Advertising<br>Introduction, Understanding Ad Placement, Understanding AdRanks, Creating First Ad Campaign, Enhance Your Ad Campaign, Performance Reports.<br>Social Media Marketing Building a Successful Strategy<br>Facebook Marketing<br>Facebook Marketing for Business, Anatomy of an Ad Campaign, Adverts, Facebook Insights, Other Marketing Tools, Other Essentials<br><br>**Self Learning Topics**:Campaign Management, Running Campaigns, Lead Generation, Qualified Leads | 07 |
| 3 | LinkedIn Marketing<br>Importance of LinkedIn Presence, LinkedIn Strategy, Sales Leads Generation Using LinkedIn, Content Strategy, LinkedIn Analytics, Targeting, Ad Campaign<br>Twitter Marketing<br>Getting Started with Twitter, Building a Content Strategy, Twitter Usage, Twitter Ads, Twitter Analytics, Twitter Tools and Tips for Marketers | 10 |

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| | | |
|---|---|---|
| | **Self Learning Topics:** LinkedIn Sales Navigator | |
| 4 | Mobile Marketing<br>Mobile Usage, Mobile Advertising, Mobile Marketing Toolkit, Mobile Marketing Features, Mobile Analytics<br><br>**Self Learning Topics**: Addressing the Diversity in India through Mobile | 06 |
| 5 | SEO<br>Search Engine, Concept of Search Engine Optimization (SEO), SEO Phases, On Page Optimization, Off Page Optimization, Social Media Reach, Maintenance<br><br>**Self Learning Topics:** SEM | 06 |
| 6 | Digital Analytics<br>Data Collection: Web logs, Benefits of Weblogs , Challenges with web logs, Key Metrics: Behaviours Analysis : visits/Session, Time on Site, Page views, Bounce Rate, Heat Map Analysis, Experience Analysis<br><br>**Self Learning Topics**: Interpretation of various Charts available in Google Analytics. How to connect Offline with Online | 06 |

**Reference Books**:

| Reference No. | Reference Name |
|---|---|
| 1 | Digital Marketing, Seema Gupta, McGraw Hill Education (India) Private Limited |
| 2 | Social Media & Mobile Marketing: Includes Online Worksheets Puneet Singh Bhatia,ISBN: 9788126578078 |
| 3 | Digital Marketing for Dummies, Ryan Deiss& Russ Henneberry, John Wiley & Son, Inc. |
| 4 | Social Media Marketing All-In-One, Jan Zimmerman, Deborah Ng, John Wiley & Sons Inc. |
| 5 | Epic Content Marketing, Joe Pulizzi, McGraw Hill Education |
| 6 | The Art of SEO, Eric Enge, Stephan Spencer, Jessie Stricchiola, O'Reilly Media Inc, |
| 7 | Digital Marketing 2020, Danny Star, |

**Tutorial/Case Studies**

Faculty can make the group of students according to class strength, Group has to present case studies based on the following topics. The Case Studies mentioned are indicative and not limited to given topics. The Teacher has the flexibility of taking similar Case Studies taking into consideration the current scenario and technological changes.

| Sr. No. | Detailed Contents | Hrs |
|---|---|---|
| 01 | Digital Marketing – Case Study : Ariel Fashion Shoot | 01 |
| 02 | Display Advertising – Case Study : Anything for Jetta | 01 |
| 03 | Search Engine Advertising – Case Study : Kotak Services | 01 |
| 04 | Social Media Marketing – Case Study : The Fall and Rise of Maggie | 01 |
| 05 | Facebook Marketing – Case Study : Tata DoCoMo | 01 |
| 06 | Facebook Marketing – Case Study : ICICI Bank – Building India's Most Social Bank on Facebook | 02 |
| 07 | LinkedIn Marketing – Case Study : Mercedes Benz, DELL | 01 |
| 08 | Twitter Marketing – Case Study : Mercedes-Benz (2011) | 01 |
| 09 | Instagram – Case Study : H & M | 01 |
| 10 | Mobile Marketing – Case Study : Philips Airfryer | 01 |
| 11 | SEO – Case Study : Barclays Business Banking SEO Campaign | 01 |
| 12 | Web Analytics – Case Study : Conversion Tracking through URL Builder – A Hotel Brand | 01 |

# Vivekanand Education Society's

# Institute of Technology

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**Internal Assessment:**
Assessment consists of one Mid Term Test of 20 marks and Continuous Assessment of 20 marks.
Mid Term test is to be conducted when approx. 50% syllabus is completed Duration of the midterm test shall be one hour.

**Continuous Assessment: -**
Continuous Assessment is of 20 marks. The rubrics for assessment will be considered on approval by the subject teachers. The rubrics can be any 2 or max 4 of the following: -

| Sr.no | Rubrics | Marks |
|---|---|---|
| 1. | *Certificate course for 4 weeks or more: -<br>NPTEL/ Coursera/ Udemy/any MOOC | 10 marks |
| 2. | Wins in the event/competition/hackathon | 10 marks |
| 3. | Content beyond syllabus presentation | 10 marks |
| 4. | Creating Proof of concept | 10 marks |
| 5. | Mini Project / Extra Experiments/ Virtual Lab | 10 marks |
| 6. | Assignment/Tutorials Based on Syllabus | 10 marks |
| 7. | Participation in event/workshop/talk / competition followed by small report and certificate of participation relevant to the subject(in other institutes) | 5 marks |
| 8. | Multiple Choice Questions (Quiz) | 5 marks |

| **End Semester Theory Examination:** | |
|---|---|
| 1 | Question paper will be of 60 marks |
| 2 | Question paper will have a total of five questions |
| 3 | All questions have equal weightage and carry 20 marks each |
| 4 | Any three questions out of five need to be solved. |

**Term Work: 25 marks**
The term work will be based on the Tutorial Performance.

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# Vivekanand Education Society's

# Institute of Technology

(An Autonomous Institute Affiliated to University of Mumbai)

| Course Code-E2 | Name of Course | Teaching Scheme | | | Credits Assigned | | |
|---|---|---|---|---|---|---|---|
| NMCAE12 | Agile Project Management | Contact Hours | | | | | |
| | | Theory | | Tutorial | Theory | Tutorial | Total |
| | | 3 | | 1 | 3 | 1 | 4 |
| | | Examination Scheme | | | | | |
| | | Theory | | | Term Work | End Sem Exam | Total |
| | | CA | MT | Tot | | | |
| | | 20 | 20 | 40 | 25 | 60 | 125 |

**Prerequisite: Knowledge of Software Engineering**

**Course Objectives: course aim to**

| Sr.No. | Course Objective |
|---|---|
| 01 | Understand the concepts of Agile Project Management. |
| 02 | Familiarize Project Management framework and Agile estimation Tools. |
| 03 | Apply knowledge of Project Life Cycle to implement the projects. |
| 04 | Understand the techniques of project scheduling & project implementation. |
| 05 | Understand the Aspects of International Projects |
| 06 | Learn software Risk Management Process. |

**Course Outcomes: On successful completion of course learner/student will be able to**

| Sr.No. | Course Outcome | Bloom Level |
|---|---|---|
| CO1 | Define the key concepts of Software Project Management. | Remembering |
| CO2 | Applying the tools for Project Scheduling | Applying |
| CO3 | Make use of estimation logic for Agile estimation of software size. | Applying |
| CO4 | Managing Scope And Procurement with Agile | Analysing |
| CO5 | Assess various factors involved in Team building and project conflict management. | Evaluating |
| CO6 | Identifying and Analysing Risk Categories | Understanding |

H

| Module | Detailed Contents | Hrs |
|---|---|---|
| 01 | **An Overview of Software Project Management:**<br>Introduction to Project, Project Management, Difference between Software Engineering & Software Project Management.<br>An Overview of IT Project Management: Define project, project management framework, The role of project Manager, Systems View of Project Management, Stakeholder management, Leadership in Projects: Modern Approaches to Leadership & Leadership Styles.<br><br>**Self Learning Topics**: Evolving role of software. | 06 |
| 02 | **Software Project Planning & Agile Estimation:** Business Case, Creating the Work Breakdown Structures (WBS).<br>Agile Software Estimation: Story points, Epics, Themes, Ideal time, Splitting the User Stories, Estimating size with story points, Estimating in Ideal Days, Techniques for estimating, choosing between story points and ideal days, splitting User stories<br><br>**Self Learning Topics**: Function Point , COCOMO | 10 |
| 03 | **Project Scheduling and Agile Procurement Management:**<br>Project Schedule, Schedule Control, Critical Path Method (CPM) (Numericals), Numerical on EVM, Basics of Procurement Management,<br>Managing Scope And Procurement with Agile: Agile Project Scoping, Agile Procurement.<br><br>**Self Learning Topics**: Change Management. | 08 |
| 04 | **Managing Participation , Teamwork and Conflict**<br>Leadership in Project Management , Participative Management , Teams in Project Management , The Team Building Approach Origins of Conflict , Consequences of Conflict, Managing conflicts, Team Methods for resolving conflicts , Emotional Stress, Stress Management<br><br>**Self Learning Topics** : Social Support to reduce Job Stress | 05 |
| 05 | **International Project Management**<br>International Projects, Problems Managing International Projects, Local Institutions and Culture , Local Stakeholders, Geo-National Issues, Project Manager, Local Representative, Top Management, Committees, and PMO, Team and Relationship Building ,Project Definition, Project Monitoring ,Communication ,Risks and Contingencies<br><br>**Self Learning Topics**: Law of Contracts and Rights at International level | 05 |
| 06 | **Risk Exposure and Risk Management Process**<br>Risk Components, Risk Categories-Risk due to Product size, Technology, Business Impact. People, Process Maturity, risk exposure Risk Management Process-Risk management planning Risk identification Qualitative risk analysis Quantitative risk analysis<br><br>**Self Learning Topics**: Risk Monitoring Tools | 05 |

**Reference Books:**

| Reference No. | Reference Name |
|---|---|
| 1 | Managing Information Technology Project, 6th edition, by Kathy Schwalbe, Cengage Learning publication. |
| 2 | Information Technology Project Management by Jack T Marchewka Wiley India Publication. |
| 3 | Agile project Management by Jason Bennett and Jennifer Bowen |
| 4 | Agile Estimating and Planning by Mike Cohn , Pearson edu |

**Web References:**

| Reference No. | Reference Name |
|---|---|
| 1 | **https://www.projectmanager.com** |
| 2 | **https://www.tutorialspoint.com** |
| 3 | **https://www.atlassian.com/agile/project-management/epics-stories-themes** |
| 4 | **https://technologyadvice.com** |

## Tutorials:-

Suggested Tutorials List, but not limited to the following Lists:-

| Sr. No. | Detailed Contents | Hrs. |
|---|---|---|
| 01 | Business Case for Project (Case study). | 02 |
| 02 | Software Requirement Specification (SRS Case Study). | 02 |
| 03 | Project Scheduling tools (any open source tools like Microsoft Projects): Creating a Project Plan or WBS, Establishing the Project Start or Finish Date, Entering Tasks. | 02 |
| 04 | Gantt chart, Critical Path Analysis. | 01 |
| 05 | Study of Agile Project Management Tool-Jira, Wrike, Monday.com,Trello, Click UP | 01 |
| 06 | Identifying Responsibilities and Qualification of Agile Project team Members for a Project (Case Study) | 01 |
| 07 | Case study on International Project | 02 |
| 08 | Identify the conflicts and stress involved in the Project undertaken | 01 |

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**Internal Assessment:**

Assessment consists of one Mid Term Test of 20 marks and Continuous Assessment of 20 marks.Mid Term test is to be conducted when approx. 50% syllabus is completed Duration of the midterm test shall be one hour.

**Continuous Assessment: -**

Continuous Assessment is of 20 marks. The rubrics for assessment will be considered on approval by the subject teachers. The rubrics can be any 2 or max 4 of the following:-

| Sr.no | Rubrics | Marks |
|---|---|---|
| 1. | *Certificate course for 4 weeks or more:- NPTEL/ Coursera/ Udemy/any MOOC | 10 marks |
| 2. | Wins in the event/competition/hackathon | 10 marks |
| 3. | Content beyond syllabus presentation | 10 marks |
| 4. | Creating Proof of concept | 10 marks |
| 5. | Mini Project / Extra Experiments/ Virtual Lab | 10 marks |
| 6. | Assignment/Tutorials Based on Syllabus | 10 marks |
| 7. | Participation in event/workshop/talk / competition followed by small report and certificate of participation relevant to the subject(in other institutes) | 5 marks |
| 8. | Multiple Choice Questions (Quiz) | 5 marks |

| **End Semester Theory Examination:** | |
|---|---|
| **1** | Question paper will be of 60 marks |
| **2** | Question paper will have a total of five questions |
| **3** | All questions have equal weightage and carry 20 marks each |
| **4** | Any three questions out of five need to be solved. |

**Term Work : 25 marks**

The term work will be based on the Tutorial Performance

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# Vivekanand Education Society's

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| Course Code-E3 | Name of Course | Teaching Scheme | | | Credits Assigned | | |
|---|---|---|---|---|---|---|---|
| NMCAE13 | Entrepreneurship Management | Contact Hours | | | | | |
| | | Theory | | Tutorial | Theory | Tutorial | Total |
| | | 3 | | 1 | 3 | 1 | 4 |
| | | Examination Scheme | | | | | |
| | | Theory | | | Term Work | End Sem Exam | Total |
| | | CA | MT | Tot | | | |
| | | 20 | 20 | 40 | 25 | 60 | 125 |

**Prerequisite: Nil**

**Course Objectives:** The course aim to

| Sr.No. | Course Objective |
|---|---|
| 1 | Instill a spirit of entrepreneurship among the student participants. |
| 2 | Provide an overview of the competences needed to become an entrepreneur. |
| 3 | Understand growth and managing strategies of venture and Social Responsibilities |
| 4 | Understand how to design an effective and efficient Business Plan for intended users. |
| 5 | Understand role of Small-Scale Industries (SSI) & Institutions Supporting Small Scale Enterprise |
| 6 | Recognize the importance of entrepreneurship and identify the profile of entrepreneurs and their role in economic growth. |

**Course Outcomes:** On successful completion of course learner/student will be able to

| Sr.No. | Outcome | Bloom Level |
|---|---|---|
| CO1 | Understand the concepts and fundamentals of Entrepreneurship. | Understanding |
| CO2 | Understand the growth and development strategies for venture and Social Responsibilities | Understanding |
| CO3 | Identify the Role of Small-Scale Industries (SSI) & Institutions Supporting Small Scale Enterprise. | Applying |
| CO4 | Analyze the process of Business Idea generation and converting the idea into a Business Model. | Analyzing |
| CO5 | Evaluate the effectiveness of different entrepreneurial strategies, policies and measures for promoting small industries. | Evaluating |
| CO6 | Create presentations and marketing strategies that articulate financial, operational, organizational, market, and sales knowledge for value creation. | Creating |

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| Module | Detailed Contents | Hrs |
|---|---|---|
| 1 | **Overview of Entrepreneurship: The Entrepreneurial Perspective**<br>Concept and Definitions: Manager, Entrepreneur, Entrepreneurship and Intrapreneurship, Importance and Significance of Growth of Entrepreneurial Activity, Traits, Characteristics, Skills and Qualities of Entrepreneurs, Classification and Types of Entrepreneurs, Emerging trends and issues in Entrepreneurship.<br><br>**Self-learning topics:**Differences Between Entrepreneurs,Intrapreneurs & Ultrapreneurs | 5 |
| 2 | **Creativity and New Venture Management**<br>**Creative Business Ideas:** Identify and Recognizing Opportunities: Observing Trends and solving problems, Creativity: Concept, Components and types, Sources of New Venture Ideas: Concept, Pre-selection Process, Sources of Business Idea, Preliminary Research, Business Idea Evaluation, Other Analysis.<br>**Writing a Business Plan:** Introduction of Business Plan, Guidelines for writing A Business Plan, Layout of Business Plan **(**Executive summary, Business Description, Industry Analysis, Market Analysis, Management Team and Company Structure, Operations Plan, Product Design and Development Plan, Financial Projections and Critical Risk Assessment, Harvest Strategy, Milestone Scheduling**)**, Presenting the Business Plan to Investors. Why some Business Plans Fail.<br><br>**Self-learning topics:** Writing business plan for benefiting to an entrepreneur | 7 |
| 3 | **Small Scale Industries Management**<br>Introduction to Small Industry: Introduction, Concept of small industry, Position in India, Role of small industries in economic development. Definition of Small-scale Industries, Undertakings, SSI Policy Statement, Procedure for SSI Registration, The Strengths and Weakness of Small Business. Reasons for the significance of the small sector, various forms of small-scale enterprises, Small Industries during various five-year Plans, Policies and measures for promoting small industries.<br><br>**Self-learning topics:** Growth and Performance of Small-Scale Industries (SSI) in India, Problems for SSI. | 7 |

| | | |
|---|---|---|
| 4 | **Entrepreneurship Development and Government**<br>**Role of Central Government and State Government in promoting Entrepreneurship** - Introduction to various incentives, subsidies and grants - Export Oriented Units - Fiscal and Tax concessions available<br>**Role of following agencies in the Entrepreneurship Development -** District Industries Centers (DIC), Small Industries Service Institute (SISI), Entrepreneurship Development Institute of India (EDII), National Institute of Entrepreneurship & Small Business Development (NIESBUD), National Entrepreneurship Development Board (NEDB)<br><br>**Self-learning topics:** List out all the Central & State Government policies implemented for Entrepreneurship Development. | 7 |
| 5 | **Marketing the Product or Service**<br>Small Business Marketing: Strategy and Research: Concept, Marketing Strategies, Market Research. Product: Heart of Marketing Mix, Purchasing, Selecting Suppliers, Managing and controlling Inventor. Place: Location Types, Layout & Design. Price and Promotion: Economics of Pricing, Break Even Analysis, Pricing-Setting Techniques, Credit Policies, Promotions.<br><br>**Self-learning topics:** Role of Digital Marketing for an entrepreneur as promoting their product. | 6 |
| 6 | **Growth and Development of the Venture & Social Responsibility**<br>Small Business Growth: Growing Firm, Transition to Professional Management, The Next Step: An Exit Strategy, Leadership in Action: Leadership Attributes, Negotiations, Delegation, Motivation Employees, HRM: Job Analysis, Recruitments, Selections, Trainings, Compensations, Introduction of Social Responsibility, Corporate Social Responsibility (CSR), Dimensions of CSR.<br><br>**Self-learning topics:** Operation management responsibilities in managing Small Business | 6 |

**Reference Books**:


| Reference No | Reference Name |
|---|---|
| 1 | Barringer, Ireland, "Entrepreneurship: Successfully Learning New Ventures", Pearson,Latest Edition |
| 2 | Robert D Hisrich, Michael P Peters, Dean A Shepherd, Entrepreneurship, Sixth Edition, The McGraw Hill Company. |
| 3 | Pocket Mentor "Creating A Business Plan", Harvard Business School Press, Boston,Massachusetts |
| 4 | David Butler "Enterprise Planning Development- Small Business Start-up Survival and Growth", Butterworth-Heinemann |
| 5 | Entrepreneurship and Small Business Management by Dr. C L Bansal, HarAnand Publications Pvt. Ltd. New Delhi, 2012 |

| | |
|---|---|
| 6 | Entrepreneurship by Lall, Madhurima. Sahai, Shikha. Excel Books, New Delhi, 2008, 2nd Edition |
| 7 | Strategic Entrepreneurship "A Decision-making approach to new venture creation and management" Philip A. Wickham, Pearson Education Society |
| 8 | "Small Business Management" Entrepreneurship and Beyond, 5th Edition, Timoth S. Hatten |
| 9 | Vasant Desai, The Dynamics of Entrepreneurial Development and Management, 2015,Himalaya Publishing House. |
| 10 | PoornimaCharantimath, Entrepreneurship Development- Small Business Enterprise,Pearson. |
| 11 | Dr TN Chhabra, Entrepreneurship Development, Sun India Publications, New Delhi |
| 12 | Dr CN Prasad, Small and Medium Enterprises in Global Perspective, New century Publications, New Delhi |


**Web References:**

| Reference No | Reference Name |
|---|---|
| 1 | http://niesbud.nic.in/ |
| 2 | http://msme.gov.in/ |
| 3 | http://ssi.nic.in/ |
| 4 | www.womenentrepreneursindia.com |
| 5 | www.msmetraining.gov.in |
| 6 | https://www.startupindia.gov.in |
| 7 | https://www.makeinindia.com |
| 8 | https://mygov.in |
| 9 | www.dcmesme.gov.in |
| 10 | www.nsic.co.in |

**EM: Tutorials**

| Sr.No. | Detailed Contents | Hrs. |
|---|---|---|
| 1 | Entrepreneurial Tasks. | 01 |
| 2 | Entrepreneurship Development in rural areas (Agriculture/Allied Business) | 01 |
| 3 | Women Entrepreneurship Development. (Case Study) | 01 |
| 4 | Team Building Activities (Board of Members/ Employees) | 01 |
| 5 | Entrepreneurship in Service Sector. | 01 |
| 6 | Preparing Business Plan | 01 |
| 7 | Scenarios for fundraising in Entrepreneurship | 01 |
| 8 | E-Business Brainstorming Activities | 01 |
| 9 | Impact of Globalization and Liberalization on SSI. | 01 |

| | | |
|---|---|---|
| 10 | Risk Management in Entrepreneurship. | 01 |
| 11 | Social Development through Entrepreneurship. | 01 |
| 12 | CSR Case Study. | 01 |

**Internal Assessment:**
Assessment consists of one Mid Term Test of 20 marks and Continuous Assessment of 20 marks.
Mid Term test is to be conducted when approx. 50% syllabus is completed Duration of the midterm test shall be one hour.

**Continuous Assessment: -**
Continuous Assessment is of 20 marks. The rubrics for assessment will be considered on approval by the subject teachers. The rubrics can be any 2 or max 4 of the following:-

| Sr.no | Rubrics | Marks |
|---|---|---|
| 1. | *Certificate course for 4 weeks or more:-<br>NPTEL/ Coursera/ Udemy/any MOOC | 10 marks |
| 2. | Wins in the event/competition/hackathon | 10 marks |
| 3. | Content beyond syllabus presentation | 10 marks |
| 4. | Creating Proof of concept | 10 marks |
| 5. | Mini Project / Extra Experiments/ Virtual Lab | 10 marks |
| 6. | Assignment/Tutorials Based on Syllabus | 10 marks |
| 7. | Participation in event/workshop/talk / competition followed by small report and certificate of participation relevant to the subject(in other institutes) | 5 marks |
| 8. | Multiple Choice Questions (Quiz) | 5 marks |

| **End Semester Theory Examination:** | |
|---|---|
| 1 | Question paper will be of 60 marks |
| 2 | Question paper will have a total of five questions |
| 3 | All questions have equal weightage and carry 20 marks each |
| 4 | Any three questions out of five need to be solved. |

**Term Work : 25 marks**
The term work will be based on the Tutorial Performance

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| Course Code | Name of Course | Contact Hours | Credits Assigned | Examination Scheme | | | |
|---|---|---|---|---|---|---|---|
| | | | | Term Work | Practical | Oral | Total |
| NMCAL11 | Python Programming Lab | 02 | 01 | 25 | 30 | 20 | 75 |

**Prerequisite:** Knowledge of some programming language like C, Java

**Course Objectives:-course aim to**

| Sr.No. | Course Objective |
|---|---|
| 1 | Understand basic concepts in Python programming. |
| 2 | Explore Object Oriented Programming using Python |
| 3 | Explore data structure using Python |
| 4 | Understand file handling in Python |
| 5 | Familiarize GUI and Database using Python |
| 6 | Understand Concepts of Threads, process and Synchronization. |

**Lab Course Outcomes:**

| Sr.No. | Outcome | Bloom Level |
|---|---|---|
| CO1 | To understand basic concepts, control statements, and functions in python. | Understanding |
| CO2 | To explore Object Oriented Programming using Python | Applying |
| CO3 | To explore data structures Linked list, stack, Queues. | Applying |
| CO4 | To understand basic concepts of file handling with Python. | Understanding |
| CO5 | To evaluate Graphical User Interface and database operations in python. | Evaluating |
| CO6 | To analyze threading modules and synchronizing threads in Python. | Analyzing |

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| Module | Detailed Content | Hours |
|---|---|---|
| 1 | **Python basics** | 4 |
| | Data types in python, Operators in python, Input and Output, Control statement, Arrays in python, String and Character in python, | |
| 2 | **Modularization and Classes** | 4 |
| | Functions, List and Tuples, Dictionaries, Exception Handling, Introduction to OOPs concepts: Classes, Objects, Interfaces, Inheritance | |
| 3 | **Data Structure in Python** | 4 |
| | Link List, Stack, Queues, Dequeues | |
| 4 | **File Handling in Python** | 5 |
| | File Handling: Opening file in different modes, closing a file, writing to a file, accessing file contents using standard library functions | |
| 5 | **Python Integration Primer** | 3 |
| | Graphical User interface, Python database connectivity | |
| 6 | **Threads in Python** | 6 |
| | Thread and Process, Starting a thread, Threading module, Synchronizing threads, Multithreaded Priority Queue | |

**Reference Books:**

| Reference No | Reference Name |
|---|---|
| 1 | Learn Python the Hard Way, 3rd Edition, Zed Shaw's Hard Way Series |
| 2 | Laura Cassell, Alan Gauld, "Python Projects", Wrox Publication |
| **Digital material:** | |
| 1 | The Python Tutorial",http://docs.python.org/release/3.0.1/tutorial/ |
| 2 | Beginning Perl,https://www.perl.org/books/beginning-perl/ |
| 3 | http://spoken-tutorial.org |
| 4 | https://starcertification.org/Certifications/Certificate/python |

**Text References:**

| Reference No | Reference Name |
|---|---|
| 1 | Dr. R. Nageswara Rao, "Core Python Programming", Dreamtech Press |
| 2 | Beginning Python: Using Python 2.6 and Python 3.1. James Payne, Wrox Publication |
| 3 | Anurag Gupta, G. P. Biswas, "Python Programming", McGraw-Hill |
| 4 | E. Balagurusamy, "Introduction to computing and problem-solving using python",McGraw Hill Education |
| 5 | Dr. R. Nageswara Rao, "Core Python Programming", Dreamtech Press |
| | Beginning Python: Using Python 2.6 and Python 3.1. James Payne, Wrox Publication |

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| Suggested experiments using Python: | |
|---|---|
| **Sr.No.** | **Title of Experiments** |
| 1 | Exploring basics of python like data types (strings, list, array, dictionaries, set, tuples) and control statements. |
| 2 | Creating functions, classes and objects using python. |
| 3 | Demonstrate inheritance and polymorphism. |
| 4 | Menu driven program for data structure using built in function for link list, stack and queue. |
| 5 | Python program to create, read and append data to existing file and display the file contents. |
| 6 | Write a Python program to understand different types of Exceptions |
| 7 | Creating GUI with Python containing widgets such as labels, textboxes, radio, checkboxes, and custom dialog boxes. |
| 8 | Creating applications for user login and registration. |
| 9 | Program to demonstrate CRUD (create, read, update and delete) operations on databases (SQLite/ MySQL) using Python. |
| 10 | Programs on Threading using Python. |

| Term Work: | |
|---|---|
| 1 | Term work should consist of 10 experiments. |
| 2 | Journal must include at least 2 assignments |
| 3 | Mini Project based on the content of the syllabus (Group of 2-3 students) |
| 4 | The final certification and acceptance of term work ensures satisfactory performance of laboratory work and minimum passing marks in term work. |
| 5 | Total 25 Marks (Journal: 10-marks, Attendance: 05-marks, and project: 10-marks) |

**Term Work: 25 marks**
The term work will be based on the Laboratory work

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| Course Code | Name of Course | Contact Hours | Credits Assigned | Examination Scheme | | | |
|---|---|---|---|---|---|---|---|
| | | | | Term Work | Practical | Oral | Total |
| NMCAL12 | Java for Full Stack Development Lab | 02 | 01 | 25 | 30 | 20 | 75 |

**Prerequisite:** 1. Basic understanding of Core Java Programming.
2. Basics of web technology.

**Lab Course Objectives:** Course is aim to

| Sr.No. | Course Objective |
|---|---|
| 1 | Write programs based on Java Generics, Collection framework and Lambda expressions. |
| 2 | Develop web applications using JSP and JSTL. |
| 3 | Demonstrate Data Access with Spring. |
| 4 | Build an application using Spring Framework. |
| 5 | Develop Spring applications using Spring Boot |
| 6 | Develop Spring Boot RESTful Web Services. |

**Lab Course Outcomes:** On successful completion of course learner/student will be able to

| Sr. No. | Outcome | Bloom Level |
|---|---|---|
| CO1 | Demonstrate use of data structure and data manipulation concept using Java Collection Framework and Lambda expressions. | Applying |
| CO2 | Build JSP web applications using standard actions, custom tags and JSTL Tags. | Creating |
| CO3 | Develop applications using Spring Framework, Lightweight Containers and Dependency Injection with Spring. | Applying |
| CO4 | Develop applications using Aspect Oriented Programming with Spring. | Applying |
| CO5 | Build JDBC application with Spring using JdbcTemplate. | Creating |
| CO6 | Develop Spring Boot Web Application and Spring Boot RESTful web services. | Creating |

**Description:**

| Module | Detailed Contents | Hrs |
|---|---|---|
| 01 | **Introduction Java EE Programming:**<br>Programs based on JSP elements, Standard Actions, JSP Directives, Implicit objects, Error handling in JSP, Session tracking – Cookies and Session, Custom tags, JSTL tags.<br><br>**Self-Learning Topics:** Simple Application using Servlet. | 4 |
| 02 | **Spring Framework:**<br>Programs based on using Spring Framework, dependency injection.<br><br>**Self-Learning Topics:** Bean Definition Profiles. | 4 |
| 03 | **Aspect Oriented Programming:**<br>Programs based on Spring AOP – Before, After, Around, After Returning and After Throwing advice, PointCuts.<br><br>**Self-Learning Topics:** AspectJ | 4 |
| 04 | **JDBC Data Access with Spring using Oracle/ MySQL database:**<br>Programs based on Spring JDBC, JdbcTemplate, PreparedStatementCallback, ResultSetExtractor and RowMapper interface.<br><br>**Self-Learning Topics:** Basic JDBC Program using DML operation. | 4 |
| 05 | **Getting Started with Spring Boot:**<br>Programs based on Spring Boot.<br><br>**Self-Learning Topics:** Understanding Transaction Management in Spring, RESTful Web Services with Spring Boot. | 6 |
| 06 | **Getting Started with ReactJs:**<br>Introduction to ReactJs, understanding JSX, React components, react class, State and Props, event, conditionals, list and forms.<br><br>**Self-Learning Topics: Model-View** Controller framework, Flux. | 4 |

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**Reference Books**:

| Reference No. | Reference Name |
|---|---|
| 1 | Java 6 Programming Black Book, Wiley–Dreamtech |
| 2 | Web Enabled Commercial Application Development using java 2.0, Ivan Byaross |
| 3 | Java Server Programming java EE6, Black book, Dreamtech Press. |
| 4 | Core Servlets and Java Server Pages: Vol. I: Core Technologies 2/e , Marty Hall and Larry Brown, Pearson |
| 5 | Java Enterprise in a Nutshell, 3rd Edition A Practical Guide, Jim Farley, William Crawford, O'Reilly |
| 6 | Java EE 6 Server Programming For Professionals, Sharanam Shah and Vaishali Shah, SPD |
| 7 | Spring in Action, Craig Walls, 3rd Edition, Manning |
| 8 | Professional Java Development with the Spring Framework, Rod Johnson et al., John Wiley & Sons |
| 9 | Beginning Spring, Mert Caliskan and Kenan Sevindik, John Wiley & Sons |
| 10 | Spring Recipes A Problem Solution Approach, Gary Mak, Josh Long and Daniel Rubio,Apress |

**Web References:**

| Reference No | Reference Name |
|---|---|
| 1 | https://docs.oracle.com |
| 2 | https://spring.io/ |

**Suggested List Of Experiments:**

| Sr.No. | Topics of Coverage |
|---|---|
| 1 | Program based on collections in java |
| 2 | Program based on Lambda and wildcard |
| 3. | Program based on web application development using JSP |
| 4. | Program based on Session Management |
| 5 | Program based on Spring Framework |
| 6 | Program based on Aspect Oriented Programming |
| 7 | Program based on Spring JDBC |
| 8 | Program based on ResultSetExtractor and RowMapper interface |
| 9 | Program based on Spring BOOT |
| 10 | Program based on ReactJS |

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| | |
|---|---|
| **Term Work:** | |
| 1 | Term work should consist of 10 experiments. |
| 2 | Journal must include at least 2 assignments. |
| 3 | The final certification and acceptance of term work ensures satisfactory performance of laboratory work and minimum passing marks in term work. |
| 4 | Total 25 Marks<br>(Experiments: 15-marks, Attendance Theory & Practical: 05-marks, Assignments: 05-marks) |
| **Continuous assessment exam** | |
| 1 | Based on the subject and related lab of NMCAL12 |

**Term Work: 25 marks**
The term work will be based on the Laboratory work

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| Course Code | Name of Course | Contact Hours | Credits Assigned | Examination Scheme | | | |
|---|---|---|---|---|---|---|---|
| | | | | Term Work | Practical | Oral | Total |
| NMCAL13 | Data Analytics Lab | 02 | 01 | 25 | 30 | 20 | 75 |

**Prerequisite**: Database Management System, SQL.

**Lab Course Objectives:** The course aims to

| Sr.No. | Course Objective |
|---|---|
| 1 | To understand methods and techniques to acquire data and apply various data preprocessing techniques. |
| 2 | To demonstrate various data visualization methods. |
| 3 | To demonstrate the processes and techniques used in diagnostic and prescriptive analytics. |
| 4 | To demonstrate various methods for predictive analytics. |
| 5 | To demonstrate the creation and analysis of business reports. |
| 6 | To apply various advanced operations for creating business dashboards. |

**Lab Course Outcomes:** On successful completion of the course, the learner/student will be able to

| Sr.No. | Outcome | Bloom Level |
|---|---|---|
| CO1 | Understand and apply various methods and techniques to acquire data and apply data preprocessing techniques. | Understanding |
| CO2 | Apply various data visualization methods. | Applying |
| CO3 | Identify the processes and techniques used in diagnostic and prescriptive analytics. | Applying |
| CO4 | Demonstrate and evaluate different various data predictive analytics techniques . | Evaluating |
| CO5 | Demonstrate the create various business reports. | Applying |
| CO6 | Apply various advanced operations for creating business dashboards | Applying |

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**Description:**

| Module No | Detailed Contents | Hrs |
|---|---|---|
| 1 | **Data Acquisition & Preprocessing :**<br>Data types and Objects, Reading and writing data, Operators, Conditional Statements, Using CSV files, Packages, attaching, and detaching data.<br>Data preprocessing techniques in R- Naming and Renaming variables, adding a new variable, Dealing with missing data, and Dealing with categorical data, Data reduction using subsetting,<br><br>**Self-Learning Topics**: Loops, Functions, Loading Data from Relational Databases, XML | 6 |
| 2 | **Descriptive Analytics:**<br>Working with R Charts and Graphs: Histograms, Boxplots, Bar Charts, Line Graphs, Scatterplots, Pie Charts, Visualization With Ggplot2.<br><br>**Self-Learning Topics:** Handling Outliers. | 4 |
| 3 | **Diagnostic and Prescriptive Analytics:**<br>Correlation Plots, EDA, Market Basket Analysis, Normal and Binomial Distributions, Univariate and Bivariate Analysis.<br><br>**Self-Learning Topics:** Themes and Transformation in Graphs, Multiple Graphs in a Single Figure. | 4 |
| 4 | **Predictive Analytics with R:**<br>Supervised Learning - Linear Regression, Classification Models Naïve Bayesian classification, K-Nearest Neighbor, Decision Tree Algorithms -ID3, C4.5, and CART..<br>Unsupervised Learning - Clustering algorithms: K-Means, K-median and hierarchical clustering.<br>**Self-Learning Topics**: GUI Development Using Rattle. | 4 |
| 5 | **Visualization:** Connect to data, Build Charts, plots, histograms, , pie charts, Treemap, Packed Bubble Chart, Analyze and Optimize Data, Highlight table,analyze geographic data to identify patterns and trends using maps and spatial visualizations<br><br>**Self-Learning Topics: Create Stories using Tableau** | 4 |
| 6 | **Advanced Operations** - Data Analysis using inbuilt Operations Preparing Maps , Analysis of Reports , Preparing Dashboards<br>Case Study : To Build a dashboard to analyze financial metrics such as revenue, expenses, and profit margins.<br>**Self Learning Topics - Tableau using web.** | 4 |

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**Reference Books:**

| Reference No | Reference Name |
|---|---|
| 1 | John M. Quick, "Statistical Analysis with R"", PACKT Publishing, 2015ISBN NO: 9781849512084, 9781849512084 |
| 2 | G.K. Gupta, "Introduction to data mining with case studies", PHI Learning Publishing, ISBN: 9788120350021, 8120350022 |
| 3 | Beginning Data Science in R_ Data Analysis, Visualization, and Modelling for the Data Scientist Thomas Mailund |
| 4 | Practical Tableau,by Ryan Sleeper , Released April 2018 , Publisher(s): O'Reilly Media, Inc. ISBN: 9781491977316 |

**Web References:**

| Reference No | Reference Name |
|---|---|
| 1 | http://cookbook-r.com |
| 2 | https://www.r-project.org/about.html |
| 3 | "Statistical Analysis with R - a quick start", Oleg Nenadic, Walter Zucchini, September 2004, http://www.statoek.wiso.uni-goettingen.de /mitarbeiter /ogi /pub /r_workshop.pdf |
| 4 | https://www.rstudio.com/ |
| 5 | http://www.r-project.org/doc/bib/R-books.html |
| 6 | Learning Tableau 2020: Create effective data visualizations, build interactive visual analytics, and transform your organization, Fourth Edition |

**Suggested List of Experiments:**

| Practical No. | Problem Statement |
|---|---|
| 1 | To implement following in R-<br>Data acquisition, Install packages, Loading packages<br>Data types, checking type of variable, printing variable and objects (Vector, Matrix, List, Factor, Data frame, Table) |
| 2 | To implement following in R-<br>cbind-ing and rbind-ing, Reading and Writing data.<br>setwd(), getwd(), data(), rm(), Attaching and Detaching data. Reading data from the consol.Loading data from different data sources.(CSV, Excel). |
| 3 | To implement following Data preprocessing techniques like,<br>Naming and Renaming variables, adding a new variable. Dealing with missing data.Dealing with categorical data. Data reduction using subsetting |
| 4 | To implement different types of Charts and Graphs like Histograms, Boxplots, Bar Charts, Line Graphs, Scatterplots, Pie Charts, |
| 5 | Implement data Visualization with Ggplot2, |
| 6 | Implement commands for drawing various Correlation Plots and learn the |

| | |
|---|---|
| | process of EDA |
| 7 | Implementation of Normal and Binomial distributions, Univariate and Bivariate Analysis, |
| 8 | Implementation and analysis of Apriori Algorithm using Market Basket Analysis |
| 9 | Implementation and analysis of Linear regression and logistic regression through graphical methods. |
| 10 | Implementation and analysis of Classification algorithms like Naive Bayesian, K-Nearest Neighbor, ID3, C4.5 |
| 11 | Implementation and analysis of clustering algorithms like K-Means and hierarchical clustering. |
| 12 | Implement various data visualization techniques . |
| 13 | Implement and analyze geographic data to identify patterns and trends using maps and spatial visualizations |
| 13 | Implementation and analysis of Reports & Dashboards using tableau |
| 14 | Implement various advanced functions in tableau. |

**Assessment:**

| Term Work: | |
|---|---|
| 1 | Term work should consist of 10 experiments. |
| 2 | Journal must include at least 2 assignments. |
| 3 | The final certification and acceptance of term work ensures satisfactory performance of laboratory work and minimum passing marks in term work. |
| 4 | Total 25 Marks<br>(Experiments: 15-marks, Attendance Theory & Practical: 05-marks, Assignments: 05-marks) |
| **Continuous assessment exam** | |
| 1 | Based on the subject and related lab of NMCAL13 |

**Term Work: 25 marks**

The term work will be based on Laboratory work.

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| Course Code | Name of Course | Contact Hours | Credits Assigned | Examination Scheme | | | |
|---|---|---|---|---|---|---|---|
| | | | | Term Work | Practical | Oral | Total |
| NMCAL14 | Skill based Lab Course: User Interface & User Experience Lab | 02 | 01 | 25 | 30 | 20 | 75 |

**Prerequisite:** Basic knowledge of Web Technologies and Software Engineering.

**Lab Course Objectives:** Course is aim to

| Sr.No. | Course Objective |
|---|---|
| 1 | Understand the importance of User Interface Design (UI) Process. |
| 2 | Analyze how to design Effective and Efficient User Interfaces for intended users. |
| 3 | Learn techniques for Prototyping and Design. |
| 4 | Learn techniques for Evaluating User Experience. |
| 5 | Understand the concept of Good UI and User Experience (UX). |
| 6 | Understand the importance of testing application design before actual implementation |

**Lab Course Outcomes:**

| Sr.No. | Outcome | Bloom Level |
|---|---|---|
| CO1 | Interpret user needs and context of User Interface design Specification | Analyzing |
| CO2 | Demonstrate the tools and techniques for designing informing models | Applying |
| CO3 | Develop a high fidelity prototype for an end to end solution. | Creating |
| CO4 | Apply best practices for evaluating user experience. | Applying |
| CO5 | Apply the concept of Good UI and User Experience (UX). | Applying |
| CO6 | Write test cases for application design | Creating |

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**Description:**

| Module No | Detailed Contents | Hrs. |
|---|---|---|
| 1 | **Introduction to UI life cycle and UI tools.** | 2 |
| 2 | **Requirement gathering (Choose the project)**<br>The project should be a web, desktop, or mobile interface. If the chosen project is a mobile application, note that it must at least be possible to simulate the project, since one of the prototypes will be such a simulation that can be evaluated. | 2 |
| 3 | **Analysis Problem statement:**<br>Briefly state the problem(s) that the project will seek to solve. Take the user's point of view. Consider what the user's goals are, and what obstacles lie in the way.<br>**Output :**<br>□ Write up a user analysis, task analysis (identify three tasks of the chosen problem), and domain analysis clearly, concisely, and completely.<br>□ A problem object model or entity-relationship diagram. | 6 |
| 4 | **Design**<br>**Creation of Scenario,Persona and Storyboard**<br>Write a scenario and story that involves all three of the tasks identified for the chosen project.<br>□ Explain the Scenario,story<br>□ Sketch the scenario and story (use any tool or hand sketches)<br>□ Draw a mental model.<br>Design persona as per the users of the application | 6 |
| 5 | **Prototype**<br>Creating a Paper Prototype and High Fidelity prototype (Wire Frame)usingFigma tool.<br>**Output**<br>□ Paper prototype<br>□ Wireframe. | 6 |
| 6 | **Usability Evaluation of the Design**<br>Testing of User Interface from Third Party(**Test scripts) Output**<br>□ Test Script | 4 |

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**Reference Books**:


| Reference No | Reference Name |
|---|---|
| 1 | Norman, Donald , The Design of Everyday Things,Basic Books, ISBN 978-0-465-06710-7 |
| 2 | Steve Krug, Don't Make Me Think, Revisited: A Common Sense, New Riders,ISBN ,Third edition, 978-0-321-96551-6 |
| 3 | Golden Krishna,The Best Interface Is No Interface, New Riders, First Edition, ISBN 978-0-133-89041-9. |
| 4 | Theo Mandel, The Elements of User Interface Design, Wiley, First Edition, 978-0471162674 |
| 5 | Wilbert O. Galitz, The Essential Guide to User Interface Design : An Introduction to GUI Design Principles and Techniques, Wiley , Second Edition, 978-8126502806 |
| 6 | Rex Hartson and Pardha S Pyla, The UX Book, Morgan Kaufmann, 9780123852410 |


**Web References:**


| Reference No | Reference Name |
|---|---|
| 1 | http://jjg.net/ia/elements.pdf |
| 2 | http://www.boxesandarrows.com |
| 3 | https://www.nngroup.com/articles/ |

**List of Experiment: (Not Limited To The Specified List)**

**Study of Real life Scenario/website and explore all aspects of UXD**

**Assessment:**

| Term Work: | |
|---|---|
| 1 | Term work should consist of 10 experiments. |
| 2 | Journal must include at least 2 assignments. |
| 3 | The final certification and acceptance of term work ensures satisfactory performance of laboratory work and minimum passing marks in term work. |
| 4 | Total 25 Marks<br>(Experiments: 15-marks, Attendance Theory & Practical: 05-marks, Assignments: 05-marks) |
| **Continuous assessment exam** | |
| 1 | Based on the subject and related lab of NMCAL14 |

**Term Work: 25 marks**

The term work will be based on Laboratory work.

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| Course Code | Name of Course | Contact Hours | Credits Assigned | Examination Scheme | | | |
|---|---|---|---|---|---|---|---|
| | | | | Term Work | Practical | Oral | Total |
| NMCAL15 | Web Application Technologies LAB | 1T+2P | 02 | 50 | 30 | 20 | 100 |

**Prerequisite:** Basic understanding of fundamentals of Web Technologies and JavaScript

**Lab Course Objectives** Course is aim to

| Sr.No. | Course Objective |
|---|---|
| 1 | Understand concepts of REPL and Node.js Console. |
| 2 | Create simple websites based on Node.js features |
| 3 | Demonstrate database connectivity and operations |
| 4 | Make applications using Typescript concepts. |
| 5 | Construct Angular Forms using fundamentals of angular. |
| 6 | Create Single page applications using Angular. |

**Lab Course Outcomes:** On successful completion of course learner/student will be able to

| Sr.No. | Outcome | Bloom Level |
|---|---|---|
| CO1 | Demonstrate the working of REPL and Node.js console. | Applying |
| CO2 | Build simple websites making use of various Node.js features | Applying |
| CO3 | Design a dynamic web application enabled with database connectivity | Creating |
| CO4 | Use the fundamentals of Typescript to build web applications. | Applying |
| CO5 | Build applications using Angular components. | Applying |
| CO6 | Develop Forms with Single page applications (SPA) | Creating |

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**Description:**

| Module No | Detailed Contents | Hrs |
|---|---|---|
| 1 | **Introduction to Node.js:**<br>What is Node.js, Advantages of Node.js, Node.js Process Model, Traditional Web Server Model, Setup Development Environment: Installation of Node.js on Windows, Working in REPL, Node JS Console<br>**Node.js Modules, Events & Functions:**<br>Standard Callback Pattern, Event Emitter Pattern, Event Types, Event Emitter API, Creating an Event Emitter.<br><br>**Self-Learning Topics**: W3C Architecture, Additional Events. | 5 |
| 2 | **File Handling & HTTP Web Server:**<br>File Paths, fs Module, opening a file, reading from a file, writing to a file, Closing a file. HTTP request/response object, Headers, Piping, Shutting down the server.<br><br>**Self-Learning Topics:**TCP server. | 9 |
| 3 | **Databases:**<br>Connect and Communicate with a MySQL Database, adding data to the database, Reading data.<br><br>**Self-Learning Topics:** Working with any other database. | 7 |
| 4 | **Typescript:**<br>Overview, TypeScript Internal Architecture, TypeScript Environment Setup, TypeScript Types, variables and operators, Decision Making and loops, TypeScript Functions, TypeScript Classes and Objects, TypeScript Modules.<br><br>**Self-Learning Topics:** Typescript Generics. | 5 |
| 5 | **Introduction to Angular:**<br>Introduction to Angular,Setup for local development environment,Angular Architecture,Angular Components and directives,Data Binding.<br><br>**Self-Learning Topics:**Styles Binding In Components. | 7 |
| 6 | **Angular Forms and Modules:**<br>Template Driven Forms,Reactive Forms,Working with Pipes,Services in Angular,Angular Routing,Angular Modules,Single Page Applications.<br><br>**Self-Learning Topics:** Custom Directives. | 6 |

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**Reference Books**:

| Reference No | Reference Name |
|---|---|
| 1 | Powell TA, Powell TA. HTML & CSS: the complete reference. New York: McGraw-Hill; 2010. ISBN No. 9780071496292 |
| 2 | Haverbeke M. Eloquent Javascript: A modern introduction to programming. No Starch Press; 2018. ISBN No. 9781593279509 |
| 3 | Teixeira P. Professional Node.js: Building Javascript based scalable software. John Wiley & Sons; 2012. ISBN No. 9781118185469 |
| 4 | Brown E. Web development with node and express: leveraging the JavaScript stack. O'Reilly Media; 2014. ISBN No. 9781491949306 |
| 5 | Karpov V, Netto D. Professional AngularJS. John Wiley & Sons; 2015. ISBN No. 9781118832073 |
| 6 | Dayley B. Learning AngularJS. Pearson Education; 2014. ISBN No. 9780134034546 |
| 7 | Seshadri S, Green B. AngularJS: Up and Running: Enhanced Productivity with Structured Web Apps. O'Reilly Media; 2014. ISBN No. 9781548785710 |

**Web Reference**

| Reference No | Reference Name |
|---|---|
| 1 | https://nptel.ac.in/courses/106106222/ |
| 2 | https://learn.shayhowe.com/html-css/ |
| 3 | https://www.w3schools.com/nodejs/ |
| 4 | https://www.coursera.org/learn/server-side-nodejs |
| 5 | https://www.tutorialspoint.com/master-typescript-learn-typescript-from-scratch/index.asp |
| 6 | https://angular.io/docs |
| 7 | https://www.freecodecamp.org/news/want-to-learn-angular-heres-our-free-33- part-course-by-dan-wahlin-fc2ff27ab451/ |

**Suggested list of experiments**

| Practical No | Problem Statement |
|---|---|
| 1 | Create an application to demonstrate Node.js Modules |
| 2 | Create an application to demonstrate various Node.js Events |
| 3 | Create an application to demonstrate Node.js Functions |
| 4 | Using File Handling demonstrate all basic file operations (Create, write, read, delete) |
| 5 | Create an HTTP Server and perform operations on it |
| 6 | Create an application to establish a connection with the MySQL database and perform basic database operations on it |

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|---|---|
| 7 | Create an application using components of typescript. |
| 8 | Create an application to demonstrate directives and pipes |
| 9 | Demonstrate features of Angular forms with a program |
| 10 | Create an application to demonstrate SPA. |

| **Term Work:** | |
|---|---|
| 1 | Term work should consist of 10 experiments. |
| 2 | Journal must include at least 2 assignments. |
| 3 | The final certification and acceptance of term work ensures satisfactory performance of laboratory work and minimum passing marks in term work. |
| 4 | Total 50 Marks<br>(Experiments: 30-marks, Attendance Theory & Practical: 10-marks, Assignments: 10-marks) |
| **Continuous assessment exam** | |
| 1 | Based on the subject and related lab of NMCAL15 |

**Term Work: 50 marks**
The term work will be based on Laboratory work

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| Course Code | Name of Course | Contact Hours | Credits Assigned | Examination Scheme | | | |
|---|---|---|---|---|---|---|---|
| | | | | Term Work | Pract. | Oral | Total |
| NMCAFP11 | Project Seminar (Real Life Problems based on Societal Issues) | 02 | 01 | 50 | - | -- | 50 |

**Prerequisite: Concept of Project Development and Management**

**Lab Course Objectives:** The course is aims to

| Sr. No. | Course Objective |
|---|---|
| 1 | To understand and identify the problem statement |
| 2 | Acquaint students with the process of applying basic computer applications and providing solutions to the problems in various application domains.. |
| 3 | Conceptualize knowledge with emphasis on critical thinking and problem-solving skills |
| 4 | Adapt to a rapidly changing environment by having learned and applied new skills. |
| 5 | To apply standard principles of project management and validate the project using appropriate evaluation measures |
| 6 | To inculcate the process of self-learning and research. |

**Lab Course Outcomes:** On successful completion of course learner/student will be able to

| Sr. No. | Course Outcome | Bloom Level |
|---|---|---|
| CO1 | Identify societal / research / innovation / entrepreneurship problems through appropriate literature surveys mapping with world sustainable goals | Understanding |
| CO2 | Use standard norms of engineering practices and project management principles during project work | Applying |
| CO3 | Build small groups to work effectively in a team on medium scale computing projects and Develop interpersonal skills to work in a group | Creating |
| CO4 | Design and evaluate solutions for complex problems | Creating |
| CO5 | Communicate through technical report writing and oral presentation. The work may result in research / article / patent / research publication | Understanding |

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|---|---|---|
| | The work may result in business plan for entrepreneurship product created | |
| CO6 | Gain technical competency by participating in project competitions and Demonstrate capabilities of self-learning, leading to lifelong learning | Applying |

| **Guidelines for Mini Project** | |
|---|---|
| 1 | Mini project may be carried out in one or more form of following: Product preparations, prototype development model, fabrication of set-ups, laboratory experiment development, process modification / development, simulation, software development, integration of software (frontend-backend) and hardware, statistical data analysis, creating awareness in society / environment, research oriented and application areas, etc. |
| 2 | Students shall form a group of 3 students, while forming a group shall not be allowed less than three or more than three students, as it is a group activity. Group will be the same till sem III project. |
| 3 | Students should do surveys and identify needs, which shall be converted into problem statements for a mini project in consultation with project mentor / head of the department / internal committee of faculties. |
| 4 | Students shall submit an implementation plan in the form of Gantt / PERT / CPM chart using state-of-the-art industry tools, which will cover weekly activity of mini projects |
| 5 | A logbook may be prepared by each group, wherein the group shall record weekly work progress, project guide shall verify and record notes / comments. |
| 6 | Students under the guidance of the mentor shall convert the best solution into a working model using various components of their domain areas and demonstrate. |
| 7 | The solution to be validated with proper justification and report to be compiled in standard format. Software requirement specification (SRS) documents as per IEEE format, research papers, and competition certificates may be submitted as part of annexure to the report. |
| 8 | With the focus on self-learning, innovation, addressing societal / research / innovation problems and entrepreneurship quality development within the students through the Mini Projects, it is preferable that a single project of appropriate level and quality be carried out in two semesters by all the groups of the students. i.e. Project Stage 1 in semesters I and II. |

**Term Work**

The review / progress monitoring committee shall be constituted by the head of department. The progress of the mini project to be evaluated on a continuous basis, based on the SRS document and log file activities submitted. Minimum two reviews in each semester are mandatory.

| **Distribution of Term work marks shall be as below:** | | **Marks (25)** |
|---|---|---|
| 1 | Marks awarded by project mentor based on logbook | 10 |
| 2 | Self-contribution and use of skill set in project | 10 |

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| | | |
|---|---|---|
| 3 | Timeliness of Project report | 05 |
| **II. Project Internal Examination (25 Marks):** | | **Marks (25)** |
| 1 | Marks awarded by review committee/Examiner | 15 |
| 2 | Individual contribution/viva/ communication skills. | 10 |
| Review / progress monitoring committee may consider following points for assessment ba as mentioned in general guidelines | | |
| **SEM I Project:** | | |
| In the first semester through Literature survey , problem statements should be freezed and the entire theoretical solution shall be made ready, including components / system selection, cost, feasibility analysis**,** conceptual and Detailed design preferably with wire frame or skeleton of the modules. Two reviews will be conducted based on a presentation given by a student group.<br>● First shall be for finalization of problem<br>● Second shall be on finalization of the proposed solution of the problem. | | |
| **Mini Project shall be assessed based on following point** | | |
| 1 | Clarity of problem and quality of literature Survey for problem identification | |
| 2 | Requirement Gathering via Software Requirement Specification (SRS) / Feasibility Study | |
| 3 | Societal / Research impact | |
| 4 | Novelty, Originality or Innovativeness of project | |
| 5 | Effective use of skill set : Standard engineering practices and Project management standard | |
| 6 | Contribution of an individual's as member or leader | |
| 7 | Completeness of methodology implemented | |
| 8 | Clarity in written and oral communication | |
| 9 | Design, Analysis and Further Plan | |
| 10 | Verification and validation of the solution / Test Cases using open source testing tools as per trends in industry | |
| 11 | Full functioning of working model as per stated requirements | |
| In first semester evaluation may be based on the first 8 criteria and remaining may be used for second semester evaluation of performance of students in mini projects. | | |
| **Guidelines for Assessment of Mini Project Practical / Oral Examination** | | |
| 1 | Report should be prepared as per the guidelines issued. | |
| 2 | The Mini Project shall be assessed through a presentation by the student project group to a panel of Internal /External Examiners preferably from industry/ research organizations having experience of more than five years /academia having experience more than 10 years approved by the head of | |

| | |
|---|---|
| | Institution. |
| 3 | Students shall be motivated to publish a research paper / patent / participate in National / International conferences based on the work. |


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# Semester II

**CURRICULUM SCHEME FOR NEP POSTGRADUATE ACADEMIC PROGRAM AT VESIT**

**2024 : Branch: MCA Semester II**

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## CURRICULUM SCHEME FOR NEP POSTGRADUATE ACADEMIC PROGRAM AT VESIT

## 2024 : Branch: MCA Semester II

| Semester II Scheme | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Type of Course | Course Code | Name of Course | Teaching Scheme (Contact Hours) | | | Credits Assigned | | | |
| | | | Theory | Pract. | Tut. | Theory | Pract. | Tut. | Total |
| Major (Mandatory) | NMCA21 | Combinatorial Algorithms for Problem Solving | 3 | -- | 1 | 3 | -- | 1 | 4 |
| Major (Mandatory) | NMCA22 | Artificial Intelligence and Machine Learning | 3 | -- | -- | 3 | -- | -- | 3 |
| Major (Mandatory) | NMCA23 | Research Methodology | 3 | -- | 1 | 3 | -- | 1 | 4 |
| Major (Elective) | NMCAE21X | Elective - 2 | 3 | -- | -- | 3 | | -- | 3 |
| Major (Elective) | NMCAE22X | Elective - 3 | 3 | -- | 1 | 3 | -- | 1 | 4 |
| Major (Mandatory) | NMCAL21 | Artificial Intelligence and Machine Learning Lab | -- | 2 | -- | -- | 1 | -- | 1 |
| Major (Elective) | NMCALE21X | Elective - 2 Lab | -- | 2 | -- | -- | 1 | -- | 1 |
| Major (Mandatory) | NMCAL23 | Soft Skill Development Lab | -- | 2 | -- | -- | 1 | -- | 1 |
| Major (Mandatory) | NMCAL24 | Skill based Lab Course. DevOps Lab | -- | 4 | -- | -- | 2 | -- | 2 |
| Major (Mandatory) | NMCAL25 | Skill based Lab Course Advanced Data Engineering with Cloud Lab | -- | 2 | -- | -- | 1 | -- | 1 |
| Field Project (OJT/FP) | NMCAFP21 | Project Stage- 1 | -- | 2 | -- | -- | 1 | -- | 1 |
| **Total** | | | **15** | **14** | **3** | **15** | **7** | **3** | **25** |

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| Semester II Marks Scheme | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Type of Course | Course Code | Name of Course | Examination Scheme | | | | | | | |
| | | | Theory | | | | | Term Work | Pract & oral | Total |
| | | | Internal Assessment | | | End Sem. Exam. | Exam. Duration (in Hrs) | | | |
| | | | MT | CA | Tot. | | | | | |
| Major (Mandatory) | NMCA21 | Combinatorial Algorithms for Problem Solving | 20 | 20 | 40 | 60 | 2 | 25 | -- | 125 |
| Major (Mandatory) | NMCA22 | Artificial Intelligence and Machine Learning | 20 | 20 | 40 | 60 | 2 | -- | -- | 100 |
| Major (Mandatory) | NMCA23 | Research Methodology | 20 | 20 | 40 | 60 | 2 | 25 | -- | 125 |
| Major (Elective) | NMCAE21X | Elective – 2 | 20 | 20 | 40 | 60 | 2 | -- | -- | 100 |
| Major (Elective) | NMCAE22X | Elective – 3 | 20 | 20 | 40 | 60 | 2 | 25 | -- | 125 |
| Major (Mandatory) | NMCAL21 | Artificial Intelligence and Machine Learning Lab | -- | -- | -- | -- | -- | 25 | 50 | 75 |
| Major (Elective) | NMCALE21X | Elective – 2 Lab | -- | -- | -- | -- | -- | 25 | 50 | 75 |
| Major (Mandatory) | NMCAL23 | Soft Skill Development Lab | -- | -- | -- | -- | -- | 50 | -- | 50 |
| Major (Mandatory) | NMCAL24 | Skill based Lab Course. DevOps Lab | -- | -- | -- | -- | -- | 50 | 50 | 100 |
| Major (Mandatory) | NMCAL25 | Skill based Lab Course Advanced Data Engineering with Cloud Lab | -- | -- | -- | -- | -- | 25 | 50 | 75 |
| Field Project (OJT/FP) | NMCAFP21 | Project Stage- 1 | -- | -- | -- | -- | -- | 50 | -- | 50 |
| **Total** | | | **--** | **--** | **200** | **300** | -- | **300** | **200** | **1050** |

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## Elective 2

| Sr. No. | Course Code | Name of Course | Lab Course Code |
|---|---|---|---|
| 1 | NMCAE211 | Internet of Things & Industrial Internet of Things | NMCALE211 |
| 2 | NMCAE212 | Design and Analysis of Algorithm | NMCALE212 |
| 3 | NMCAE213 | Software Testing & Quality Assurance | NMCALE213 |

## Elective 3

| Sr. No. | Course Code | Name of Course |
|---|---|---|
| 1 | NMCAE221 | Cyber Security and Laws |
| 2 | NMCAE222 | Design Thinking |
| 3 | NMCAE223 | Risk Analysis Management |

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**SEM II**

| Course Code | Name of Course | Teaching Scheme | | | Credits Assigned | | |
|---|---|---|---|---|---|---|---|
| NMCA21 | Combinatorial Algorithms for Problem Solving | Contact Hours | | | | | |
| | | Theory | | Tutorial | Theory | Tutorial | Total |
| | | 3 | | 1 | 3 | 1 | 4 |
| | | Examination Scheme | | | | | |
| | | Theory | | | Term Work | End Sem Exam | Total |
| | | CA | MT | Total | | | |
| | | 20 | 20 | 40 | 25 | 60 | 125 |

**Prerequisite:** Basic knowledge of Mathematics and Statistics

**Course Objectives:** Course is aim to

| Sr.No | Course Objective |
|---|---|
| 1 | Study the formulation of Linear programming problems and obtain the optimum solution using various methods. |
| 2 | Solve the transportation and obtain their optimal solution |
| 3 | Solve the assignment problems and obtain their optimal solution |
| 4 | Develop the abilities in project evaluation techniques. |
| 5 | Understand job sequencing and solve real world problems. |
| 6 | Understand simulation models and analyze their performance in real world systems |

**Course Outcomes:** On successful completion of course learner/student will be able to

| Sr. No. | Outcome | Bloom Level |
|---|---|---|
| CO1 | Formulate mathematical models for a broad range of problems in business and industry. | Creating |
| CO2 | Apply mathematics and mathematical modelling to forecast implications of various choices in real world problems | Applying |
| CO3 | Think strategically and decide the optimum alternative from various available options | Evaluating |
| CO4 | Apply PERT/CPM in project evaluation. | Applying |
| CO5 | To Minimize the cost or time of completion of a sequencing problem. | Evaluating |
| CO6 | Evaluate performance parameters of a real system using simulation methods. | Evaluating |

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| Module No | Detailed Contents | Hrs |
|---|---|---|
| 01 | **Linear Programming Problem**: Introduction, Formulation of linear programming problem and basic feasible solution: graphical method, Simplex method, artificial variables, Big M method, Two Phase method.<br><br>**Self-Learning Topics:**special cases of LPP | 10 |
| 02 | **Transportation Problem**: Definition of Transportation Problem, Initial basic feasible solution: North-West Corner method, Least Cost method, Vogel's Approximation method, optimum solution: MODI method.<br><br>**Self Learning Topics:** optimization using stepping stone method | 6 |
| 03 | **Assignment Problem & Travelling Salesman Problem**: Definition of assignment Problem : Hungarian method (minimization and maximization), Traveling Salesman Problem : Hungarian method.<br><br>**Self Learning Topics:** Simple applications in daily life | 6 |
| 04 | **PERT and CPM**<br>Time estimates, earliest expected time, latest allowable occurrence time, latest allowable occurrence time and slack time, Critical path, Probability of meeting scheduled date of completion of project, Calculation of CPM network ,Various floats for activities.<br><br>**Self Learning Topics:** Project crashing. | 7 |
| 05 | **Sequencing Problem**<br>Two machines n jobs , three machines n jobs, n machines m jobs<br><br>**Self Learning Topics:** Use of sequencing in real world problems | 4 |
| 06 | **Simulation**: Introduction to simulation, steps in simulation, advantages of simulation, limitations of simulation, applications of simulation, Monte-Carlo method: simple examples, single server queue model. Able Baker call center problem.Simulation of inventory system (Newspaper seller problem)<br><br>**Self Learning Topics:** Generation of pseudo random numbers and their properties. | 6 |

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**Reference Books**:


| Reference No | Reference Name |
|---|---|
| 1 | Hamdy A. Taha, University of Arkansas, "Operations Research: An Introduction", Pearson, 9th Edition, ©2011, ISBN-13: 9780132555937 |
| 2 | Sharma, S.D. and Sharma, H. , "Operations Research: Theory, methods and Applications",KedarNath Ram Nath, 2010, 15, reprint |
| 3 | J. K. Sharma, "Operations Research : Theory And Applications" , Macmillan India Limited, 2006 (3 Edition),ISBN 1403931518, 9781403931511 |
| 4 | S. C. Gupta, "Fundamentals of Statistics" – Himalaya Publishing House, 2017,7th edition, ISBN 9350515040, 9789350515044 |
| 5 | Prem Kumar Gupta & D S Hira, S. Chand publications , Operations Research", 7/e, ISBN-13: 978-8121902816, ISBN-10: 9788121902816 |
| 6 | A. Ravindran, Don T. Phillips, James J. Solberg, "Operations Research: Principles and Practice", 2nd Edition, January 1987, ISBN: 978-0-471-08608-6 |
| 7 | Frederick S. Hillier, Gerald J. Lieberman, Introduction to Operations Research , McGraw-Hill, 2001,Edition7, illustrated,ISBN 0071181636, 9780071181631 |
| 8 | Jerry Banks, John S. Carson, Barry L. Nelson, Contributor Barry L. Nelson "Discrete-event System Simulation",Prentice Hall, 1996, edition 2, illustrated, ISBN 0132174499, 9780132174497 |


**Web References:**


| Reference No | Reference Name |
|---|---|
| 1 | Operations Research, Prof.Kusum Deep, IIT-MADRAS, https://nptel.ac.in/courses/111/107/111107128/ |
| 2 | Introduction to Operations Research, Prof. G. Srinivasan, IIT-ROORKEE, https://nptel.ac.in/courses/110/106/110106062/ |
| 3 | Fundamentals of Operations Research, Prof. G. Srinivasan, IIT-MADRAS, https://nptel.ac.in/courses/112/106/112106134/ |
| 4 | Modeling and simulation of discrete event systems,Prof.P. Kumar Jha, IIT-ROORKEE, https://nptel.ac.in/courses/112107220/ |
| 5 | Game Theory, Prof. K. S. MallikarjunaRao, IIT-BOMBAY, https://nptel.ac.in/courses/110/101/110101133/ |
| 6 | Decision Modelling, Prof. BiswajetMahanty, IIT-KHARGPUR, https://nptel.ac.in/courses/110105082/ |
| 7 | Karmarkar's Method: https://www.youtube.com/watch?v=LWXXhBIlj0o |
| 8 | Karmarkar's Method : https://en.wikipedia.org/wiki/Karmarkar%27s_algorithm |


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**Tutorials:**

| Sr. No. | Topic | Hrs |
|---|---|---|
| 1 | Linear programming problem using graphical method | 1 |
| 2 | Linear programming problem using simplex method | 1 |
| 3 | Linear programming problem using Big M method | 1 |
| 4 | Finding the basic feasible solution using Vogel's Approximation Method | 1 |
| 5 | Finding the optimal solution using Modi Method | 1 |
| 6 | Assignment Problem using Hungarian method | 1 |
| 7 | Traveling salesman Problem using Hungarian method | 1 |
| 8 | Critical Path method and PERT | 1 |
| 9 | 2 job sequencing and 3 job sequencing | 1 |
| 10 | Single server queue simulation | 1 |

**Internal Assessment:**

Assessment consists of one Mid Term Test of 20 marks and Continuous Assessment of 20 marks. Mid Term test is to be conducted when approx. 50% syllabus is completed Duration of the midterm test shall be one hour.

**Continuous Assessment: -**

Continuous Assessment is of 20 marks. The rubrics for assessment will be considered on approval by the subject teachers. The rubrics can be any 2 or max 4 of the following: -

| Sr.no | Rubrics | Marks |
|---|---|---|
| 1. | *Certificate course for 4 weeks or more: -<br>NPTEL/ Coursera/ Udemy/any MOOC | 10 marks |
| 2. | Wins in the event/competition/hackathon | 10 marks |
| 3. | Content beyond syllabus presentation | 10 marks |
| 4. | Creating Proof of concept | 10 marks |
| 5. | Mini Project / Extra Experiments/ Virtual Lab | 10 marks |
| 6. | Assignment/Tutorials Based on Syllabus | 10 marks |

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|---|---|---|
| 7. | Participation in event/workshop/talk / competition followed by small report and certificate of participation relevant to the subject (in other institutes) | 5 marks |
| 8. | Multiple Choice Questions (Quiz) | 5 marks |

| **End Semester Theory Examination:** | |
|---|---|
| 1 | Question paper will be of 60 marks |
| 2 | Question paper will have a total of five questions |
| 3 | All questions have equal weightage and carry 20 marks each |
| 4 | Any three questions out of five need to be solved. |

**Total 25 Marks**
(Experiments/Tutorials: 15-marks, Attendance Theory & Practical: 05-marks, Assignments: 05-marks)

**Term Work: 25 marks**
The term work will be based on the Tutorial Performance

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| Course Code | Name of Course | Teaching Scheme | | | Credits Assigned | | |
|---|---|---|---|---|---|---|---|
| | | Contact Hours | | | | | |
| | | Theory | Tutorial | | Theory | Tutorial | Total |
| NMCA22 | Artificial Intelligence And Machine Learning | 3 | -- | | 3 | -- | 3 |
| | | Examination Scheme | | | | | |
| | | Theory | | | Term Work | End Sem Exam | Total |
| | | CA | MT | Total | | | |
| | | 20 | 20 | 40 | -- | 60 | 100 |

**Prerequisite:** Basics of data mining and Mathematical foundations of computer science.

**Course Objectives:** Course is aim to

| Sr.No. | Course Objective |
|---|---|
| 1 | Study Artificial Intelligence concepts and applications . |
| 2 | Elucidate knowledge of Artificial Intelligence techniques for problem solving. |
| 3 | Become familiar with Artificial neural networks and error correction methods in neural network. |
| 4 | Become familiar with the fundamentals of machine learning algorithms, and the paradigms for forecasting and classification |
| 5 | Become familiar fundamentals of kernel machines and ensemble methods. |
| 6 | Study dimensionality reduction techniques for feature selection . |

**Course Outcomes:** On successful completion of the course, students will be able to

| Sr.No. | Outcome | Bloom Level |
|---|---|---|
| CO1 | Understand Artificial Intelligence concepts and applications and | Understanding |
| CO2 | Apply knowledge of Artificial Intelligence techniques for problem solving. | Applying |
| CO3 | Understand Artificial neural networks and error correction methods in neural network | Understanding |
| CO4 | Analyze the fundamentals of machine learning algorithms, and the paradigms for forecasting and classification . | Analyzing |
| CO5 | Apply fundamentals of kernel machines and ensemble methods. | Applying |
| CO6 | Apply dimensionality reduction techniques for feature selection | Applying |

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| Module | Detailed Contents | Hrs |
|---|---|---|
| 1 | **Introduction:** Definition of Artificial Intelligence, The Foundations of Artificial Intelligence, The History and Application of AI, AI Problem Formulation.<br>**Intelligent Agents:** Types of Agents, Agent Environments, PEAS representation of an Agent, Architectures of Intelligent Agents.<br><br>**Self-Learning topics**: Expert System | 6 |
| 2 | **Search Strategies:** Solving problems by searching, Problem-Solving Agents, Search-Issues in the Design of Search Programs, Uninformed Search Strategies: BFS and DFS; Heuristic Search Techniques: Generate and Test search, Hill Climbing, Greedy Best-First Search, A*Algorithm, AO*Algorithms; Adversarial Search Techniques: The minimax algorithm, Heuristic Alpha–Beta Tree Search.<br><br>**Self-Learning topics**: Tabu search | 8 |
| 3 | **Artificial Neural Networks:** Introduction, Activation Functions, McCulloch-Pitts Neuron; Supervised Learning Networks: Perceptrons, Adaline, Multiple Adaptive Linear Network and Backpropagation Algorithms Training Procedures, Optimization algorithm-Gradient descent; Unsupervised Learning Networks: Maxnet algorithm,Generative Adversarial Networks (GANs), Tuning the Network parameters, Introduction to RNN and CNN.<br><br>**Self-Learning topics:** Fuzzy Logic | 10 |
| 4 | **Introduction to Machine Learning:** Machine Learning Basics, Types of Learnings, Application of ML, Data Mining vs.MachineLearning vs. Big Data Analytics, Designing a Learning System, Design Issues in Machine Learning,<br>**Forecasting and Learning Theory:** Multiple and Non-linear regression, Logistic regression, Random Forest, Bayesian Belief networks, Bias/variance tradeoff, Tuning Model Complexity, Model Selection Dilemma.<br><br>**Unsupervised Machine Learning models:** Expectation-Maximization Algorithm,Model-Based Clustering, Clustering High-Dimensional, Evaluating Hypothesis.<br>**Self-Learning topics:** Maximum Likelihood Estimation | 6 |

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|---|---|---|
| 5 | **Kernel Machines and Ensemble Methods**<br>Introduction, Optimal Separating Hyperplane, Separating data with maximum margin, Support Vector Machine (SVM), Finding the maximum margin, The Non-Separable case: Soft Margin Hyperplane, Kernel Trick, Defining Kernels<br>Ensemble Methods: Bagging, Stacking, Boosting,, Implementing the AdaBoost algorithm, Classifying with AdaBoost , Bootstrapping and cross Validation<br><br>Self-**Learning topics:** SMO Algorithm | 5 |
| 6 | **Dimensionality Reduction**: Introduction, Subset Selection, Principal Component Analysis, Multidimensional Scaling, and Linear Discriminant Analysis.<br><br>**Self-Learning topics;** Feature selection, feature ranking and subset selection | 4 |

**Reference Books:**


| Reference No | Reference Name |
|---|---|
| 1 | George F Luger, Artificial Intelligence, Fifth Edition-2009, Pearson Education Publications, ISBN-978-81-317-2327-2 |
| 2 | Stuart Russell, Peter Norvig, Artificial Intelligence – A Modern Approach, , Pearson Education / Prentice Hall of India, 3rd Edition, 2009 .ISBN- 13: 978- 0136042594 |
| 3 | Elaine Rich, Kevin Knight, and S.B. Nair, Artificial Intelligence, 3rd Edition, Tata McGraw Hill-2008., ISBN 10: 0070087709 / ISBN 13: 9780070087705 |
| 4 | Anandita Das ,Artificial Intelligence and Soft Computing for Beginners-,2nd Edition, ShroffPublication, ISBN- 9789351106159 |
| 5 | Nils J. Nilsson, Artificial Intelligence: A new Synthesis, Morgan Kaufmann Publishers, Harcourt Asia Pvt. Ltd., 2000, ISBN-1-55860-535-5 |
| 6 | Kumar Satish ,Neural Networks, Second Edition, Tata McGraw Hill-,2013, 2013, ISBN 1259006166, 9781259006166 |
| 7 | EthemAlpaydn, Introduction to Machine Learning, PHI, Third Edition, ISBN No. 978-81-203- 5078-6. |
| 8 | Peter Harrington, Machine Learning in Action . Manning Publications , April 2012, ISBN 9781617290183 |
| 9 | Tom Mitchell, Machine Learning, Mcgraw-Hill, First Edition, ISBN No. 0-07- 115467-1. |
| 10 | Christopher M. Bishop, Pattern Recognition and Machine Learning, Mcgraw- Hill, ISBN No. 978-81-322-0906-5 |
| 11 | ShaiShalev-Shwartz and Shai Ben David ,Understanding Machine Learning From Theory to Algorithms, Cambridge University Press, First Edition, ISBN No. 978-1-107-05713-5 |


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**Web References:**

| Reference No | Reference Name |
|---|---|
| 1 | nptel.ac.in-A first course in Artificial Intelligence-Deepak Khemani, |
| 2 | nptel.ac.in -Introduction to machine learning – BalaramanRavindran, IITMadras |
| 3 | Tutorial point.com/machine_learning_with_python/index.htm |

**Internal Assessment:**

Assessment consists of one Mid Term Test of 20 marks and Continuous Assessment of 20 marks. Mid Term test is to be conducted when approx. 50% syllabus is completed Duration of the midterm test shall be one hour.

**Continuous Assessment:-**

Continuous Assessment is of 20 marks. The rubrics for assessment will be considered on approval by the subject teachers. The rubrics can be any 2 or max 4 of the following:-

| Sr.no | Rubrics | Marks |
|---|---|---|
| 1. | *Certificate course for 4 weeks or more:- NPTEL/ Coursera/ Udemy/any MOOC | 10 marks |
| 2. | Wins in the event/competition/hackathon | 10 marks |
| 3. | Content beyond syllabus presentation | 10 marks |
| 4. | Creating Proof of concept | 10 marks |
| 5. | Mini Project / Extra Experiments/ Virtual Lab | 10 marks |
| 6. | Assignment/Tutorials Based on Syllabus | 10 marks |
| 7. | Participation in event/workshop/talk / competition followed by small report and certificate of participation relevant to the subject(in other institutes) | 5 marks |
| 8. | Multiple Choice Questions (Quiz) | 5 marks |

| **End Semester Theory Examination:** | |
|---|---|
| 1 | Question paper will be of 60 marks |
| 2 | Question paper will have a total of five questions |
| 3 | All questions have equal weightage and carry 20 marks each |
| 4 | Any three questions out of five need to be solved. |

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| Course Code | Name of Course | Teaching Scheme (Teaching Hours) | | | Credits Assigned | | | |
|---|---|---|---|---|---|---|---|---|
| | | Theory | Practical | Tutorial | Theory | TW/PR | Tut | Total |
| NMCA23 | **Research Methodology** | **03** | **---** | **01** | **03** | **---** | **01** | **04** |

| Course Code | Name of Course | Examination Scheme | | | | | |
|---|---|---|---|---|---|---|---|
| | | Theory | | | Term Work | Practical & Oral | Total |
| | | Internal Assessment | | End Sem Exam | | | |
| | | Mid-Term Test | Continuous Assessment | | | | |
| NMCA23 | **Research Methodology** | **20** | **20** | **60** | **---** | **---** | **100** |

| | |
|---|---|
| **Course Prerequisite:** Data Presentation / handling techniques, Reporting Tools | |
| **Course Objectives:** | |
| 1 | To cultivate a thorough grasp of Research Identification |
| 2 | To achieve proficiency in Research types and Research Design. |
| 3 | To learn diverse methods and procedures during research design. |
| 4 | To learn to apply research data collection methods and analysis. |
| 5 | To apply various concepts to Interpret and write Research Reports. |
| | |
| **Course Outcomes:** After successful completion of the course students will be able to: | |
| **1** | Develop a comprehensive understanding of Research definition and defining research problems. |
| **2** | Acquire proficiency in Research types ,Research Design and data sampling techniques |
| **3** | learn various methods for Research Design. |
| **4** | Understanding various methods and Techniques for research data collection and analysis |
| **5** | Applying various concepts to present a research report and interpret |

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## Research Methodology (Theory)

| Module | Contents | Hrs |
|---|---|---|
| 1 | **Introduction to Definition of Research:** Research Definition; Objective of research. Various functions that describe characteristics of research such as systematic, valid, verifiable, empirical and critical approach, Objectives of Research, Motivation in Research, Types of Research, Research Approaches, Significance of Research, Research Methods versus Methodology.<br>Defining the Research Problem: Identify Research Problem, Selecting the Problem, Necessity of Defining the Problem, Technique Involved in Defining a Problem. | 8 |
| 2 | **Types of Research:** Pure and applied research. Descriptive and explanatory research. Qualitative and quantitative approaches. Formulating the Research Problem, Literature Review, Developing the objectives, Preparing the research design including sample Design, Sample size, Census and Sample Survey , Implications of a Sample Design , Steps in Sampling Design, Criteria of Selecting a Sampling Procedure | 10 |
| 3 | **Research Design:** Meaning of Research Design, Need for Research Design, Features of a Good Design, Important Concepts Relating to Research Design-Dependent and independent variables, Extraneous variable, Control, Different Research Designs, Basic Principles of Experimental Designs- Important Experimental Designs, Informal experimental designs, Formal experimental designs. | 08 |
| 4 | **Methods of Data Collection and Analysis:** Observation Method, Collection of Primary Data, Interview Method, Collection of Data through Questionnaires, Some Other Methods of Data Collection, Collection of Secondary Data, Collection of Data through Schedules, Difference between Questionnaires and Schedules, Processing Operations, Some Problems in Processing, Elements/Types of Analysis | 07 |
| 5 | **Interpretation and Report Writing:** Meaning of Interpretation, Why Interpretation? Technique of Interpretation: Precaution in Interpretation, Significance of Report Writing, Different Steps in Writing Report, Layout of the Research Report, Types of Reports, Oral Presentation, Mechanics of Writing a Research Report,Precautions for Writing Research Reports. | 06 |

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|---|---|
| **Textbooks:** | |
| 1 | Kothari, C.R., 1985, Research Methodology-Methods and Techniques, New Delhi, Wiley Eastern Limited. |
| 2 | Dawson, Catherine, 2002, Practical Research Methods, New Delhi, UBS Publishers' Distributors. |
| **Reference Books:** | |
| 1 | Kumar, Ranjit, 2005, Research Methodology-A Step-by-Step Guide for Beginners, (2nd.ed), Singapore, Pearson Education. |
| 2 | Shrivastava, Shenoy& Sharma, Quantitative Techniques for Managerial Decisions, Wiley. |
| 3 | Goode WJ & Hatt PK, Methods in social research, McGraw Hill. |
| 4 | Basic Computer Science and Communication Engineering - R. Rajaram (SCITECH). |
| **Online Resources:** | |
| 1 | https://www.bing.com/search?q=alison.com%0Ahttps%3A%2F%2Falison.com%2Ffree-learning%2Fdiploma-courses&form=IPRV10 |
| 2 | https://researchmethod.net/methodology/ |
| 3 | https://paperpal.com/blog/academic-writing-guides/what-is-research-methodology |
| 4 | https://www.educba.com/types-of-research-methodology/ |
| 5 | https://www.researchprospect.com/research-methodology/ |
| 6 | https://onlinecourses.nptel.ac.in/noc24_ge21/preview |

**Tutorials: Suggested Tutorial Topics/list but not limited to the following topics**

| Sr No | Topic |
|---|---|
| 1 | Developing a Research Plan : Identify, Literature Survey ,Design and Formulate a Research Problem |
| 2 | Understanding Research Ethics |
| 3 | Effect of Redundant publications: duplicate and overlapping publications |
| 4 | Importance of plagiarism in Research:Use of plagiarism software like Turnitin, Urkund and other open source software tools |
| 5 | Write a comprehensive note on the "Task of defining a research problem" |
| 6 | Publication misconduct: definition, concept, problems that lead to unethical behavior and vice versa, types |

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|---|---|
| 7 | Writing Complete Research Proposals |

**Internal Assessment:**

Assessment consists of one Mid Term Test of 20 marks and Continuous Assessment of 20 marks.
Mid Term test is to be conducted when approx. 50% syllabus is completed.
Duration of the midterm test shall be one hour.

**Continuous Assessment:**

Continuous Assessment is of **20 marks**. The rubrics for assessment will be considered on approval by the subject teachers. The rubrics can be any 2 or max 4 of the following:

| Sr. No | Rubrics | Marks |
|---|---|---|
| 1 | Certificate course for 4 weeks or more: NPTEL/ Coursera/ Udemy/any MOOC | 10 marks |
| 2 | Wins in the event/competition/hackathon | 10 marks |
| 3 | Content beyond syllabus presentation | 10 marks |
| 4 | Creating Proof of concept | 10 marks |
| 5 | Mini Project | 10 marks |
| 6 | GATE Based Assignment test/Tutorials etc | 10 marks |
| 7 | Participation in event/workshop/talk / competition followed by small report and certificate of participation relevant to the subject (in other institutes) | 05 marks |
| 8. | Multiple Choice Questions (Quiz) | 05 marks |
| 9. | Peer Review and participation | 05 Marks |

| **End Semester Theory Examination:** | |
|---|---|
| 1 | Question paper will be of 60 marks |
| 2 | Question paper will have a total of five questions |
| 3 | All questions have equal weightage and carry 20 marks each |
| 4 | Any three questions out of five needs to be solved. |

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| Course Code | Name of Course | Teaching Scheme | | | Credits Assigned | | |
|---|---|---|---|---|---|---|---|
| NMCAE211 | Internet of Things & Industrial Internet of Things | Contact Hours | | | | | |
| | | Theory | Tutorial | | Theory | Tutorial | Total |
| | | 3 | -- | | 3 | -- | 3 |
| | | Examination Scheme | | | | | |
| | | Theory | | | Term Work | End Sem Exam | Total |
| | | CA | MT | Total | | | |
| | | 20 | 20 | 40 | -- | 60 | 100 |

**Prerequisite:** 1. Knowledge of Computer Networks.
2. Basics of Cloud.

**Course Objectives**: Course is aim to

| Sr.No. | Course Objective |
|---|---|
| 1 | Explain the basics of IoT, M2M, IoT enabling technologies, characteristics of IoT systems and IoT levels. |
| 2 | Explain different state of art IoT reference models and architectures as well as Architecture Reference Model (ARM) for IoT. |
| 3 | Explain the IoT protocols aspects and generic design methodology. |
| 4 | Explain the IoT security aspects and generic design methodology. |
| 5 | Discuss IoT applicability in various domains along with the concept of Web of Thing (WoT). |
| 6 | Discuss IoT applicability in various domains along with the concept of Cloud of Thing (CoT). |

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**Course Outcomes**: On successful completion of course learner/student will be able to

| Sr.No. | Outcome | Bloom Level |
|---|---|---|
| **CO1** | Compare M2M and IoT; discuss applicability of IoT enabling technologies, characteristics of IoT systems and IoT levels. | Understanding |
| **CO2** | Explain different state of art IoT reference models and architectures as well as Architecture Reference Model (ARM) for IoT | Understanding |
| **CO3** | Analyze various protocols for IoT security aspects and generic design methodology | Analyzing |
| **CO4** | Analyze various protocols for IoT and generic design methodology | Applying |
| **CO5** | Develop a web based IoT Model for specific domains. | Applying |
| **CO6** | Develop cloud based IoT Model for specific domains. | Applying |

| Module | Detailed Contents | Hrs |
|---|---|---|
| **1** | **Introduction to IoT and M2M**<br>● Introduction of Basic electronics and its components working<br>● Definition & Characteristics of IoT Physical Design of IoT- Things in IoT<br>● Logical Design of IoT- IoT Functional Blocks, IoT Communication Models, IoT Communication APIs<br>● IoT Enabling Technologies- Wireless Sensor Networks, Cloud Computing, Big Data Analytics, Communication Protocols, Embedded Systems<br>● IoT Levels & Deployment Templates- IoT Level-1, IoT Level-2, IoT Level-3<br>● M2M to IoT – The Vision: Introduction<br>● From M2M to IoT<br>● A brief background,<br>● M2M communication,<br>● Differing characteristics<br>●<br>**Self-Learning Topics:**<br>● IoT Level-4, IoT Level-5, IoT<br>● Level-6 M2M to IoT – A Market Perspective M2M to IoT – An Architectural Overview | **8** |

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|---|---|---|
| 2 | **IoT Architecture:**<br>Introduction State of the Art<br>● European Telecommunications Standards Institute M2M/oneM2M<br>● International Telecommunication Union Telecommunication sector view<br>● Internet Engineering Task Force architecture fragments<br>● Open Geospatial Consortium Architecture. Architecture Reference Model<br>● Introduction,<br>● Reference model and architecture,<br>IoT reference model<br>● IoT domain model, Information model, Functional model,<br>● Communication model, Safety, privacy, trust, security model<br>● IoTReference Architecture<br>● Introduction, Functional view, Information view, Deployment and operational view<br><br>**Self-Learning Topics**: Other relevant architectural views | **11** |
| 3 | **IoT Protocols and Security:**<br>● IoT Protocols :<br>● Protocol Standardization for IoT Efforts, M2M and WSN Protocols, SCADA and RFID Protocols, Issues with IoT Standardization, Unified Data Standards, Protocols – IEEE 802.15.4, BACnet Protocol, Modbus, KNX, Zigbee Architecture, Network layer, APS layer.<br>● IoT Security: Need for IoT Security,IoTVulnerabilities, Elements of IoT Security, IoT<br>● Security best practices, Threat Modeling an IoT system<br><br>**Self Learning Topics:** Basics of Internet Protocols, Basic understanding of cryptography | **6** |
| 4 | **IoT Platform Design Methodology:**<br>● Purpose and requirement specification Process specification<br>● Domain model specification Information model specification Service specifications<br>● IoT level specification Functional view specification Operational view specification<br>● Device and component integration Application development<br><br>**Self Learning Topics:** Basics of DFD, UML Modeling | **4** |

| | | |
|---|---|---|
| 5 | **Domain SpecificIoTs:**<br>HomeAutomation<br>• Smart Lighting & Smart Appliances<br>• Intrusion Detection & Smoke/Gas Detectors Cities<br>• Smart Parking & Smart Lighting<br>• Smart Roads & Structural Health Monitoring<br>• Surveillance & Emergency Response Environment<br>• Weather Monitoring<br>• Air Pollution Monitoring<br>• Noise Pollution Monitoring<br>• Forest Fire Detection<br>• River Floods Detection Energy<br>• Smart Grids<br>• Renewable Energy Systems<br>• Prognostics Retail<br>• Inventory Management<br>• Smart Payments<br>• Smart Vending Machines Agriculture<br>• Smart Irrigation<br>• GreenHouse Control Industry<br>• Machine Diagnosis & Prognosis.<br>• Indoor Air Quality Monitoring<br>**Self Learning Topics:** Case Study on Logistics and Health & Lifestyle | 6 |
| 6 | **IIOT and Cloud of Things:**<br>Role of IIOT in Manufacturing Processes, Wireless sensor network (WSN) and Internet of Things (IoT), Business models: Saas, Paas, Iaas., big-data analytics infrastructures<br><br>**Self Learning Topics:**Basics of Web and Cloud. | 4 |

**Reference Books**

| Reference No | Reference Name |
|---|---|
| 1 | From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence, Jan Holler,VlasiosTsiatsis, Catherine Mulligan, Stefan Aves and StamatisKarnouskos, David Boyle, ELSEVIER |
| 2 | Vijay Madisetti and ArshdeepBahga, "Internet of Things (A Hands-on-Approach)", 1 st Edition, VPT, 2014 |

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|---|---|
| 3 | IoT Security for Dummies, Lawrence Miller, John Wiley & Sons Ltd. |
| 4 | Practical Internet of Things Security, Brian Russell, Drew Van Duren, PACKT publishing |
| 5 | The Internet of Things in the Cloud:A Middleware Perspective,By Honbo Zhou |
| 6 | Rethinking the Internet of Things A Scalable Approach to Connecting Everything, Francis daCosta, Apress |
| 7 | Getting Started with the Internet of Things, CunoPfister |
| 8 | The Internet of Things: Connecting Objects,HakimaChaouchi |

**Internal Assessment:**
Assessment consists of one Mid Term Test of 20 marks and Continuous Assessment of 20 marks. Mid Term test is to be conducted when approx. 50% syllabus is completed. Duration of the mid term test shall be one hour.

**Continuous Assessment:-**
Continuous Assessment is of 20 marks. The rubrics for assessment will be considered on approval by the subject teachers. The rubrics can be any 2 or max 4 of the following:-

| Sr.no | Rubrics | Marks |
|---|---|---|
| 1. | *Certificate course for 4 weeks or more:- NPTEL/ Coursera/ Udemy/any MOOC | 10 marks |
| 2. | Wins in the event/competition/hackathon | 10 marks |
| 3. | Content beyond syllabus presentation | 10 marks |
| 4. | Creating Proof of concept | 10 marks |
| 5. | Mini Project / Extra Experiments/ Virtual Lab | 10 marks |
| 6. | Assignment/Tutorials Based on Syllabus | 10 marks |
| 7. | Participation in event/workshop/talk / competition followed by small report and certificate of participation relevant to the subject(in other institutes) | 5 marks |
| 8. | Multiple Choice Questions (Quiz) | 5 marks |

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| **End Semester Theory Examination:** | |
|---|---|
| 1 | Question paper will be of 60 marks |
| 2 | Question paper will have a total of five questions |
| 3 | All questions have equal weightage and carry 20 marks each |
| 4 | Any three questions out of five need to be solved. |

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| Course Code | Name of Course | Teaching Scheme | | | Credits Assigned | | |
|---|---|---|---|---|---|---|---|
| | | Contact Hours | | | | | |
| | | Theory | Tutorial | | Theory | Tutorial | Total |
| NMCAE212 | Design and Analysis of Algorithm | 3 | -- | | 3 | -- | 3 |
| | | Examination Scheme | | | | | |
| | | Theory | | | Term Work | End Sem Exam | Total |
| | | CA | MT | Total | | | |
| | | 20 | 20 | 40 | -- | 60 | 100 |

**Prerequisite:** Basics of data mining and Mathematical foundations of computer science-MCA11

**Course Objectives:** Course is aim to

| Sr.No. | Course Objective |
|---|---|
| 1 | Analyze asymptotic notations. |
| 2 | Analyze various Divide and conquer problem solving techniques |
| 3 | Analyze greedy algorithm strategies. |
| 4 | Analyze dynamic programming strategies. |
| 5 | Analyze backtracking, branch and bound and string matching algorithm. |
| 6 | Interpret approximation algorithms. |

**Course Outcomes:** On successful completion of the course, students will be able to

| Sr.No. | Outcome | Bloom Level |
|---|---|---|
| CO1 | To analyze the time and space complexity of various algorithms. | Analyzing |
| CO2 | To construct and analyze divide and conquer strategies. | Analyzing |
| CO3 | To construct and analyze greedy algorithm strategies. | Analyzing |

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| | | |
|---|---|---|
| **CO4** | To develop and analyze dynamic programming strategies. | Analyzing |
| **CO5** | To analyze backtracking, branch and bound and string matching algorithms. | Analyzing |
| **CO6** | Explain NP hard NP complete problem. | Understanding |

| Module | Detailed Content | Hrs |
|---|---|---|
| 1 | **Module: Introduction :**<br>Notion of an Algorithm , Fundamentals of Algorithmic Problem Solving, Fundamentals of the Analysis of Algorithmic Efficiency, Asymptotic Notations and their properties. Analysis Framework, Mathematical analysis for Recursive and Non-recursive algorithms, Substitution method and growth of function.<br><br>**Self-Learning topics**: algorithms based on their worst-case, best-case, or average-case time or space complexities | 4 |
| 2 | **Module:Divide And Conquer:**<br>Divide and Conquer Methodology, Binary Search, Merge sort, Quick sort, Heap Sort, Multiplication of Large Integers, Closest- Pair and Convex- Hull Problems<br><br>**Self Learning Topics:** Optimal storage on tape | 7 |
| 3 | **Module: Greedy Technique:**<br>Introduction, Control Abstraction for Greedy Algorithms, Fractional knapsack, Minimum cost spanning tree(Kruskal, Prims) , Single source shortest path (Dijkstra's algorithm)<br><br>**Self Learning Topics:** Huffman Coding | 8 |
| 4 | **Module: Dynamic Programming:**<br>Introduction, Control Abstraction for Dynamic Programming, Knapsack (0/1), Matrix chain multiplication, Longest common subsequence, All pair shortest path (Floyd Warshall)<br><br>**Self Learning Topics: DFS and BFS** | 8 |

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|---|---|---|
| 5 | **Module: Backtracking And Brach And Bound, String Matching:**<br>Introduction to Backtracking, n-Queen problem, Graph colouring problem, Hamiltonian cycle.<br>Branch and Bound, LIFO Search and FIFO search, Least cost search, 15 puzzles, Travelling Salesman Problem. Naïve string-matching Algorithms Rabin Karp algorithm , Knuth-Morris-Pratt algorithm<br><br>**Self Learning Topics:** Subset Sum Problem | 10 |
| 6 | **Module: Approximation Algorithms:**<br>NP Hard and NP –complete problem, set covers, Natural algorithms<br>**Self Learning Topics:** Study of open ended problems | 2 |

**Reference Books:**


| Reference No | Reference Name |
|---|---|
| 1 | Thomas H.Cormen, Charles E.Leiserson, Ronald L. Rivest and Clifford Stein,—Introduction to Algorithms, Third Edition, PHI Learning Private Limited, 2012 ISBN 978-0-262-03384-8. |
| 2 | AnanyLevitin, —Introduction to the Design and Analysis of Algorithms, Third Edition, Pearson Education, 2012 ISBN 978 0 13 231681 1 |
| 3 | Ellis Horowitz, SartajSahni and SanguthevarRajasekaran - Computer Algorithms/ C++, Second Edition, Universities Press, 2007 ISBN: 9788173716126 |
| 4 | S. Sridhar —Design of Algorithms and Analysis, Oxford university press, 2014. |
| 5 | Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, —Data Structures and Algorithms, Pearson Education, Reprint 2006 |
| 6 | Harsh Bhasin, —Algorithms Design and Analysis, Oxford university press, 2016. |
| 7 | Parag H. Dave, Himanshu B. Dave, "Design and Analysis of Algorithms", 1st Edition, 2008, ISBN: 8177585959, Pearson Education. |


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**Web References:**

| Reference No | Reference Name |
|---|---|
| 1 | nptel.ac.in- Design and analysis of algorithms - Prof. Madhavan Mukund, |
| 2 | nptel.ac.in - Design and Analysis of Algorithms – Prof. Abhiram G Ranade, Prof. Ajit A Diwan, Prof. Sundar Viswanathan |
| 3 | nptel.ac.in- Design and Analysis of algorithms-- By Dr. Faheem Syeed Masoodi \| University of Kashmir |

**Internal Assessment:**
Assessment consists of one Mid Term Test of 20 marks and Continuous Assessment of 20 marks. Mid Term test is to be conducted when approx. 50% syllabus is completed. Duration of the midterm test shall be one hour.

**Continuous Assessment:-**
Continuous Assessment is of 20 marks. The rubrics for assessment will be considered on approval by the subject teachers. The rubrics can be any 2 or max 4 of the following:-

| Sr.no | Rubrics | Marks |
|---|---|---|
| 1. | *Certificate course for 4 weeks or more:- NPTEL/ Coursera/ Udemy/any MOOC | 10 marks |
| 2. | Wins in the event/competition/hackathon | 10 marks |
| 3. | Content beyond syllabus presentation | 10 marks |
| 4. | Creating Proof of concept | 10 marks |
| 5. | Mini Project / Extra Experiments/ Virtual Lab | 10 marks |
| 6. | Assignment/Tutorials Based on Syllabus | 10 marks |
| 7. | Participation in event/workshop/talk / competition followed by small report and certificate of participation relevant to the subject(in other institutes) | 5 marks |
| 8. | Multiple Choice Questions (Quiz) | 5 marks |

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# Vivekanand Education Society's

# Institute of Technology

**(An Autonomous Institute Affiliated to University of Mumbai)**

| **End Semester Theory Examination:** | |
|---|---|
| 1 | Question paper will be of 60 marks |
| 2 | Question paper will have a total of five questions |
| 3 | All questions have equal weightage and carry 20 marks each |
| 4 | Any three questions out of five need to be solved. |

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# Vivekanand Education Society's

# Institute of Technology

(An Autonomous Institute Affiliated to University of Mumbai)

| Course Code | Course Name | Teaching Scheme | | | Credits Assigned | | |
|---|---|---|---|---|---|---|---|
| NMCAE213 | Software Testing & Quality Assurance | Contact Hours | | | | | |
| | | Theory | | Tutorial | Theory | Tutorial | Total |
| | | 3 | | - | 3 | - | 3 |
| | | Examination Scheme | | | | | |
| | | Theory | | | Term Work | End Sem Exam | Total |
| | | CA | MT | Total | | | |
| | | 20 | 20 | 40 | - | 60 | 100 |

**Prerequisite:** Software Engineering

**Course Objectives:** Course is aim to

| Sr.No. | Course Objective |
|---|---|
| 1 | To provide a comprehensive knowledge of software testing concepts, principles,process models, and various testing techniques. |
| 2 | To have an in-depth understanding of various static testing strategies. |
| 3 | To acquire knowledge of dynamic software testing methodologies. |
| 4 | To learn test management and incident management procedures. |
| 5 | To acquire fundamental knowledge of the test automation and testing tools. |
| 6 | To gain thorough knowledge of software quality, measurement, and metrics. |

**Course Outcomes:** On successful completion of course learner/student will be able to

| Sr.No. | Outcome | Bloom Level |
|---|---|---|
| CO1 | Understand fundamental concepts, principles, process models, and various software testing techniques. | Understanding |
| CO 2 | Apply various static testing strategies. | Applying |
| CO 3 | Apply various dynamic testing methodologies. | Applying |
| CO 4 | Understand and apply the procedure for test management and incident management. | Applying |
| CO5 | Adapt essential knowledge of test automation and testing tools effectively. | Understanding |

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| | | |
|---|---|---|
| **CO6** | Evaluate software quality using ISO standards, measurements and metrics. | Evaluating |

| Module | Detailed Contents | Hrs |
|---|---|---|
| 1 | **Basics of Software Testing**<br><br>Testing & Debugging, Principles of Testing, Test Metrics, Verification and Validation, The General V-Model, W-Model, Component Test, Integration Test, System Test, Acceptance Test, Generic types of Testing- Functional, Non Functional, Testing software structure, Regression Testing, Agile Testing, Web based testing<br><br>**Self-Learning Topic:** Tool used for different types of testing | 8 |
| 2 | **Static Testing**<br><br>Structured Group Examinations - Reviews, Static Analysis - Control Flow Analysis & Data Flow Analysis, Tools for Static Testing.<br>**Self-Learning Topic:** Continuous Integration and Continuous Testing, Security Testing | 4 |
| 3 | **Dynamic Testing**<br><br>Black Box Testing- Equivalence Class Partitioning, Boundary Value Analysis, State Transition Test, Cause Effect Graphing and Decision Table Technique, User Documentation Testing, Domain Testing<br><br>White Box-Statement Coverage, Branch Coverage, Test of Conditions, Path Coverage, Data Flow testing, Mutation testing.<br><br>**Self-Learning Topic:** Agile Testing | 8 |
| 4 | **Test Management**<br><br>Test organization, structure and of testing group, detailed test design and test Specification,Test Planning ,Test Process, Test Reporting, Incident Management – Test Log, Incident Reporting, Classification, Status<br><br>**Self-Learning Topic:** Case studies on optimizing the test process | 5 |

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|---|---|---|
| **5** | **Test Automation**<br><br>Design and Architecture for Automation, Test Automation Design and Architecture for Automation, Generic Requirements for test Tool/Framework, Criteria for selecting test tools, Testing of Object Oriented Systems<br><br>Study of testing tools: JIRA, Bugzilla, TestDirector and IBM Rational Functional Tester, Selenium etc.<br><br>**Self-Learning Topic:** Automation testing frameworks and TDD | **7** |
| **6** | **Software Quality, Software Measurement & Metrics**<br><br>Five Views of software quality, ISO 9126 Quality Characteristics, ISO 9000:2000 & Latest Software Quality Standards, SQA Planning: SQA plan Organizational Level Initiatives. Measurement during Software Life Cycle Context, Defect Metrics, Metrics for software Maintenance & Requirements, Measurement Principles.<br><br>**Self-Learning Topic:**McCall's Quality Model, Boehm's Quality Model, CMMI, Six Sigma | **7** |

**Reference Books:**


| Reference No | Reference Name |
|---|---|
| 1 | Software Testing Foundations, Andreas Spillner, Tilo Linz, Hans Schaefer, Shoff Publishers and Distributors |
| 2 | "Foundations of Software Testing", by Aditya P. Mathur – Pearson Education custom edition 2000. |
| 3 | "The ART of Software Testing", by Glenford J. Myers, Wiley India, Second Edition |
| 4 | "Software Testing: Principles and Practices", by Srinivasan D and Gopalswamy R, Pearson Ed, 2006. |
| 5 | "Software Testing & Quality Assurance Theory & Practice" By Kshirasagar Naik & Priyadarshi Tripathi, Wiley Student Edition. |
| 6 | "Software Quality Assurance Principles & Practice", by Nina S. Godbole, Narosa Stephan H.Kan, |


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**Web References:**

| Reference No | Reference Name |
|---|---|
| 1 | https://www.softwaretestinghelp.com/ |
| 2 | https://www.guru99.com/software-testing.html |
| 3 | https://www.softwaretestingcertificationcourses.com/ |
| 4 | https://www.geeksforgeeks.org/software-testing-vs-quality-assurance/ |
| 5 | https://onlinecourses.nptel.ac.in/noc22_cs61/preview |

**Internal Assessment:**
Assessment consists of one Mid Term Test of 20 marks and a Continuous Assessment of 20 marks.
Mid Term test is to be conducted when approx. 50% syllabus is completed Duration of the midterm test shall be one hour.

**Continuous Assessment: -**
Continuous Assessment is of 20 marks. The rubrics for assessment will be considered on approval by the subject teachers. The rubrics can be any 2 or max 4 of the following: -

| Sr.no | Rubrics | Marks |
|---|---|---|
| 1. | *Certificate course for 4 weeks or more: -<br>NPTEL/ Coursera/ Udemy/any MOOC | 10 marks |
| 2. | Wins in the event/competition/hackathon | 10 marks |
| 3. | Content beyond syllabus presentation | 10 marks |
| 4. | Creating Proof of concept | 10 marks |
| 5. | Mini Project / Extra Experiments/ Virtual Lab | 10 marks |
| 6. | Assignment/Tutorials Based on Syllabus | 10 marks |
| 7. | Participation in an event/workshop/talk/competition followed by a small report and certificate of participation relevant to the subject (in other institutes) | 5 marks |
| 8. | Multiple Choice Questions (Quiz) | 5 marks |

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# Vivekanand Education Society's

# Institute of Technology

**(An Autonomous Institute Affiliated to University of Mumbai)**

| **End Semester Theory Examination:** | |
|---|---|
| 1 | Question paper will be of 60 marks |
| 2 | Question paper will have a total of five questions |
| 3 | All questions have equal weightage and carry 20 marks each |
| 4 | Any three questions out of five need to be solved. |

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# Vivekanand Education Society's

# Institute of Technology

(An Autonomous Institute Affiliated to University of Mumbai)

| Course Code | Course Name | Teaching Scheme | | | Credits Assigned | | | |
|---|---|---|---|---|---|---|---|---|
| | | Contact Hours | | | | | | |
| | | Theory | | Tutorial | Theory | Tutorial | Total | |
| NMCAE221 | Cyber Security and Laws | 3 | | 1 | 3 | 1 | 4 | |
| | | Examination Scheme | | | | | | |
| | | Theory | | | Term Work | End Sem Exam | Total | |
| | | CA | MT | Total | | | | |
| | | 20 | 20 | 40 | 25 | 60 | 125 | |

**Prerequisite:** NIL

**Course Objectives:** Course is aim to

| Sr.No. | Course Objective |
|---|---|
| 1 | Understand the basics of cyber security |
| 2 | To have an overview of various cryptographic techniques and network protocols |
| 3 | Acquire knowledge of various cybercrimes and tools used in cybercrime |
| 4 | Learn the fundamentals of security policies, risk assessment, and compliance |
| 5 | Acquire fundamental knowledge of cyber laws |
| 6 | Understand different aspects of Indian IT Act 2008 and its latest amendments |

**Course Outcomes:** On successful completion of course learner/student will be able to

| Sr.No. | Outcome | Bloom Level |
|---|---|---|
| CO1 | Demonstrate understanding of basic concepts in cyber security | Understanding |
| CO 2 | Apply various cryptographic techniques and network protocols | Applying |
| CO 3 | Have in-depth knowledge of various Cybercrime and methods used in cybercrime | Analysing |
| CO 4 | Understand the core principles of security policies, risk assessment, and compliance | Understanding |
| CO5 | Adapt essential understanding of Cyberspace | Understanding |
| CO6 | To gain insight into and apply IT law in various legal issues | Applying |

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| Module | Detailed Contents | Hrs |
|---|---|---|
| 1 | **Introduction to Cyber Security, Compliance and Governance:** Cybercrime and origins of the word, Cybercrime and information security, Classifications of cybercrime. Cyber security increasing threat landscape, Cyber security terminologies- Cyberspace, attack, attack vector, attack surface, threat, risk, vulnerability, exploit, exploitation, hacker, Non-state actor<br><br>**Self-learning Topic:** Ethical aspects related to new technologies- AI/ML, IoT, Blockchain | 6 |
| 2 | **Basics of Cryptography and Network Security:** Concepts of encryption and decryption, Symmetric and asymmetric cryptography, Cryptographic algorithms and their applications; Fundamentals of network security, Network protocols and vulnerabilities, Firewalls, IDS, and IPS<br><br>**Self-learning Topic:** Digital signatures, Public Key Infrastructure (PKI) | 6 |
| 3 | **Cybercrimes & Tools** How criminals plan attacks, Industrial Spying/Industrial Espionage, Hacking, E-Mail Spoofing, Spamming, data diddling, salami attacks, Cyber defamation, Internet Time Theft, Social Engineering, Cyber stalking,Botnets, Cloud computing, Password Cracking, Keyloggers and Spywares, Virus , worms and trojans, APTs, Steganography, DoS and DDoS Attacks, SQL Injection, Buffer Overflow, Identity Theft (ID Theft) Proliferation of Mobile and Wireless Devices, Trends in Mobility, Attacks on Wireless Networks, Security Challenges Posed by Mobile Devices<br><br>**Self-learning Topic:** Threat Intelligence | 7 |
| 4 | **Cyber Security Management:** Cyber security Plan- cyber security policy, cyber crisis management plan., Business continuity, Risk assessment, Types of security controls and their goals, Cybersecurity audit and compliance.<br><br>**Self-learning Topic:** National cyber security policy and strategy. | 6 |
| 5 | **Cyberspace:** E-Commerce , The Contract Aspects in Cyber Law ,The Security Aspect of Cyber Law ,The Intellectual Property Aspect in Cyber Law , The Evidence Aspect in Cyber Law , The Criminal Aspect in Cyber Law, Global Trends in | 7 |

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|---|---|---|
| | Cyber Law , Legal Framework for Electronic Data Interchange Law Relating to Electronic Banking , The Need for an Indian Cyber Law<br><br>**Self-learning Topic:** SOX, GLBA, HIPAA, ISO, FISMA, NERC, PCI | |
| **6** | **Indian IT Act:**<br>Cyber Crime and Criminal Justice : Penalties, Adjudication and Appeals Under the IT Act, 2000, IT Act. 2008 and its Amendments<br><br>**Self-learning Topic:** Critical IT and National Critical Infrastructure | **7** |

**Reference Books:**


| Reference No | Reference Name |
|---|---|
| 1 | Nina Godbole, SunitBelapurCyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives –, Wiley India Publications<br>Released: April 2011 |
| 2 | Anthony Reyes, The Best Damn Cybercrime and Digital Forensic Book Period,Jack Wiles |
| 3 | Investigating Network Intrusions and Cybercrime EC-Council \| Press |
| 4 | Computer Forensic investing Network Intrusions and cybercrime by Course Technology |
| 5 | Michael Gregg & David Kim, Inside Network Security Assessment: Guarding Your IT Infrastructure, Pearson Publication |
| 6 | Suresh T. Vishwanathan-The Indian Cyber Law; Bharat Law House New Delhi |
| 7 | B.B. Gupta, D.P. Agrawal, Haoxiang Wang, Computer and Cyber Security: Principles, Algorithm, Applications, and Perspectives, CRC Press, ISBN 9780815371335,2018 |
| 8 | Cyber Security Essentials, James Graham, Richard Howard and Ryan Otson, CRC Press. |
| 9 | Introduction to Cyber Security, Chwan-Hwa(John) Wu, J. David Irwin, CRC Press T&F Group |


**Web References:**


| Reference No | Reference Name |
|---|---|
| 1 | Cybersecurity and Infrastructure Security Agency. (n.d.). Cybersecurity overview. Retrieved July 15, 2024, from<br>https://www.cisa.gov/cybersecurity-overview<br>https://www.cisa.gov/cybersecurity-considerations-businesses |
| 2 | Infosec. (2023). Cybersecurity threats: Types, prevention and examples. Retrieved |


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|---|---|
| | July 15, 2024, from https://www.infosecinstitute.com/cybersecurity-threats-types-prevention-examples |
| 3 | Khan Academy. (n.d.). Cryptography. Retrieved July 15, 2024, from https://www.khanacademy.org/computing/computer-science/cryptography |
| 4 | Cisco. (n.d.). Network Security Basics. Retrieved July 15, 2024, from https://www.cisco.com/c/en/us/products/security/network-security-basics.html |
| 5 | National Institute of Standards and Technology (NIST). (2022). Cybersecurity Framework. Retrieved July 15, 2024, from https://www.nist.gov/cyberframework |
| 6 | ISACA. (n.d.). Cybersecurity Management. Retrieved July 15, 2024, from https://www.isaca.org/resources/cybersecurity-management |
| 7 | Symantec. (n.d.). Internet Security Threat Report. Retrieved July 15, 2024, from https://www.symantec.com/security-center/threat-report |
| 8 | International Association of Privacy Professionals (IAPP). (n.d.). Privacy Basics. Retrieved July 15, 2024, from https://iapp.org/resources/article/privacy-basics/ |
| 9 | European Union Agency for Cybersecurity (ENISA). (n.d.). Data Protection and Privacy. Retrieved July 15, 2024, from https://www.enisa.europa.eu/topics/data-protection-and-privacy |


**TUTORIAL :**

| Sr.No | Detailed content | Hrs. |
|---|---|---|
| **1** | Given a list of cases, identify whether it falls under the category of virus, worms, or trojans. | **1** |
| **2** | Cyber Laws of other countries | **1** |
| **3** | Movies, Web Series, and other videos on Cyber Crime | **1** |
| **4** | Case Study: Darknet, Social media, Cyber terrorism, Cyberwarfare | **1** |
| **5** | Two real-life case studies related to data diddling, salami attacks, and social engineering. Also, explain what precautions need to be taken for these attacks. | **2** |
| **6** | Any real-life cases that were booked under the following sections:<br>1. Section 65<br>2. Sections 66A,66B,66C,66D,66E,66F | **1** |
| **7** | SQL injection technique. Make a presentation slide and demonstrate. | **1** |
| **8** | Take any 2 cyber crimes( Online scams & Frauds- email scams, Phishing, Vishing, Smishing, Online job fraud, Online sextortion), and explain them in detail as a presentation. Also, download its related video to demonstrate it in | **2** |

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|---|---|---|
| | class. | |
| **9** | Prepare a case study on any one of these topics: Debit/ credit card fraud, Online payment fraud, Pornographic Offenses | **1** |
| **10** | Screen lock bypassing techniques and different of password-cracking methods | **1** |
| **11** | Study and summarize few research papers on : Cyberbullying, Cybersquatting, Cyber grooming, Pharming, Cyber café and Cybercrimes, | **1** |

**Internal Assessment:**
Assessment consists of one Mid Term Test of 20 marks and a Continuous Assessment of 20 marks.
Mid Term test is to be conducted when approx. 50% syllabus is completed Duration of the midterm test shall be one hour.

**Continuous Assessment: -**
Continuous Assessment is of 20 marks. The rubrics for assessment will be considered on approval by the subject teachers. The rubrics can be any 2 or max 4 of the following: -

| **Sr.no** | **Rubrics** | **Marks** |
|---|---|---|
| 1. | *Certificate course for 4 weeks or more: -<br>NPTEL/ Coursera/ Udemy/any MOOC | 10 marks |
| 2. | Wins in the event/competition/hackathon | 10 marks |
| 3. | Content beyond syllabus presentation | 10 marks |
| 4. | Creating Proof of concept | 10 marks |
| 5. | Mini Project / Extra Experiments/ Virtual Lab | 10 marks |
| 6. | Assignment/Tutorials Based on Syllabus | 10 marks |
| 7. | Participation in an event/workshop/talk/competition followed by a small report and certificate of participation relevant to the subject (in other institutes) | 5 marks |
| 8. | Multiple Choice Questions (Quiz) | 5 marks |

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| End Semester Theory Examination: | |
|---|---|
| 1 | Question paper will be of 60 marks |
| 2 | Question paper will have a total of five questions |
| 3 | All questions have equal weightage and carry 20 marks each |
| 4 | Any three questions out of five need to be solved. |

**Term Work: 25 marks**

The term work will be based on the Tutorial Performance

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| Course Code | Name of Course | Teaching Scheme (Teaching Hours) | | | Credits Assigned | | | |
|---|---|---|---|---|---|---|---|---|
| | | Theory | Practical | Tutorial | Theory | TW/PR | Tut | Total |
| NMCAE222 | Design Thinking | 03 | --- | 01 | 03 | --- | 01 | 04 |

| Course Code | Name of Course | Examination Scheme | | | | | |
|---|---|---|---|---|---|---|---|
| | | Theory | | | Term Work | Practical & Oral | Total |
| | | Internal Assessment | | End Sem Exam | | | |
| | | Mid-Term Test | Continuous Assessment | | | | |
| NMCAE222 | Design Thinking | 20 | 20 | 60 | 25 | --- | 125 |

| | |
|---|---|
| **Course Prerequisite:** NA | |
| **Course Objectives:** | |
| 1 | To cultivate a thorough grasp of Design Thinking's definition, principles, and practical applications. |
| 2 | To achieve proficiency in Design Thinking methodologies and processes, encompassing the 5-stage approach and various implementation strategies. |
| 3 | To learn diverse methods and tools during the Empathize and Design phases of product development within the framework of Design Thinking. |
| 4 | To learn to apply design thinking tools and methods in ideation stage |
| 5 | To comprehend different prototype methods and learn the importance of testing. |
| 6 | To apply Design Thinking principles through case studies and real-world scenarios, fostering practical understanding and proficiency in problem-solving and innovation. |
| | |
| **Course Outcomes:** After successful completion of the course students will be able to: | |
| **1** | Develop a comprehensive understanding of Design Thinking's definition, principles, and applications |
| **2** | Acquire proficiency in Design Thinking methodologies and processes, encompassing the 5-stage approach and diverse implementation strategies. |

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|---|---|
| **3** | learn various methods/tools for Empathize and Design phases in product development through Design Thinking. |
| **4** | Tackle idea generation challenges by employing techniques such as brainstorming, mind mapping, and ideation tools, prioritizing visualization and empathy prior to generating ideas. |
| **5** | Understanding various prototype types and methods, implementing focused experiments, exploration maps, and minimum viable products. |
| **6** | Applying interdisciplinary collaboration, ethics, culture, global perspectives, and technology integration in real-world scenarios. |
| | |
| **Learning Outcomes:** | |
| **1** | To identify opportunities, empathize with users, generate innovative solutions, and prepare effective design briefs. |
| **2** | Students will learn to use design thinking resources, principles, and the 5-stage process to solve case studies effectively. |
| **3** | Students will learn to apply various methods and tools for the empathize and design phases, finalize problem statements, and use design thinking for product development. |
| **4** | Students will learn to apply various methods and tools for the empathize and design phases, finalize problem statements, and use design thinking for product development. |
| **5** | Students will learn to create and test various prototypes, collect feedback, and iterate to improve ideas. |
| **6** | Gain insights into the impact of cross-disciplinary collaborations, ethical considerations, cultural sensitivity, global perspectives, and technology integration on real-world business and societal challenges. |

## Design Thinking (Theory)

| Module | Contents | Hrs |
|---|---|---|
| 1 | **Introduction to Design Thinking** | 05 |
| | **Design Thinking Background:**<br>Definition, Importance, Origin, Design Vs Design Thinking, Problem Solving and Need, Principles of Design Thinking, Business Uses, Variety within the Design Thinking Discipline<br>**Design Thinking Approach:**<br>Empathy, Ethnography, Divergent Thinking, Visual Thinking, Assumption Testing and Prototyping<br>Activities for Tutorials<br>Identify an Opportunity and Scope of the Project | |

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| | | |
|---|---|---|
| | Explore the possibilities and prepare a design brief | |
| 2 | Design thinking process and methodology. | 08 |
| | **Design Thinking Resources**:<br>Organization , People, Place, Material<br>**Principles of Design Thinking**<br>**Design Thinking Processes**<br>**Design Thinking Methodology**<br>The 5 Stages of the Design Thinking Process- Empathize,Define (the problem), Ideate, Prototype, and Test.<br>Activities for Tutorials<br>Identify design thinking process and methodology which will be useful for your case study and also identify the important applicable principles. | |
| 3 | Empathize and Design | 07 |
| | **Methods and Tools for Empathize and Design phases**<br>Ask 5 Why (5W+H Questions), Stakeholder and Empathy Map<br>Peer Observation, Trend Analysis, Data Gathering methods, Observation, Focus Graph, Interview, Q&A, Design Thinking Application, Design Thinking Applied to product development.<br>Activities for Tutorials<br>Apply the methods of empathizing and Define Phases Finalize the problem statement. | |
| 4 | Design Thinking in Practice | 07 |
| | **Visualisation and Ideation**<br>Challenges in idea generation, Visualize, Empathize, and Ideate method, Importance of visualizing and empathizing before ideating. Ideation Tools: How Might We? (HMW), Storyboard, Mind mapping,Brainstorming, Affinity diagram.<br>Activities for Tutorials<br>Apply the methods of Ideate Phase: Generate Lots of Ideas. | |
| 5 | Prototyping and Testing | 08 |
| | **Prototyping** | |

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| | | |
|---|---|---|
| | Types of Prototype, Methods of prototyping, focused experiments, exploration map , minimum viable product, Testing prototypes with users<br>Activities for Tutorials<br>Apply the Methods of the Prototype Phase: Create prototypes for selected ideas. Collect feedback, iterate and improve the ideas. | |
| 6 | Case Studies/Real World Application | 04 |
| | **Case Studies and Real World Applications**<br>Important considerations: Cross Disciplinary Collaborations,Ethical consideration, cultural sensitivity and global perspective,technology integration.<br>Activities for Tutorials<br>Find out any one use case considering the above discussed factors that have impacted the real world business/society. | |

| **Tutorials** |
|---|
| Student have to study a case study of any area of interest i.e Healthcare,Aviation,Insurance ets, and perform the above mentioned tutorials. |

| **Textbooks:** | |
|---|---|
| 1 | Idris Mootee, ―Design Thinking for Strategic Innovation: What They Can't Teach You at Business or Design School‖, Wiley, 2017. (e-book)<br>https://www.aitskadapa.ac.in/e-books/CSE/DESIGN%20THINKING/Design%20Thinking%20for%20Strategic%20Innovation_%20What%20They%20Can_t%20Teach%20You%20at%20Business%20or%20Design%20School%20(%20PDFDrive%20).pdf |
| 2 | Tim Brown, "Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation".(e-book)<br>http://hozekf.oerp.ir/sites/hozekf.oerp.ir/files/kar_fanavari/manabe%20book/Thinking/Change%20by%20Design_%20How%20Design%20Thinking%20Transforms%20Organizations%20and%20Inspires%20Innovation%20.pdf |
| 3 | Christian Müller-Roterberg, "Handbook of Design Thinking", Kindle Direct Publishing ISBN:978-1790435371, November 2018 (https://www.researchgate.net/publication/329310644_Handbook_of_Design_Thinking). |
| **Reference Books:** | |

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|---|---|
| 1 | Gavin Ambrose, Paul Harris, "Basics Design - 8: Design Thinking", illustrated, reprint, AVAPublishing, 2010 |
| 2 | Christine Charyton, Creative Engineering Design Assessment, Springer |
| 3 | Warren K Wake Wake, Design Paradigms: A Sourcebook for Creative Visualization, JohnWiley & Sons |
| **Online Resources:** | |
| 1 | https://www.gasq.org/files/content/gasq/downloads/certification/Design%20Thinking/DesignThinking_Syllabus_0-6-3_EN.pdf |
| 2 | https://www.cuelogic.com/blog/core-principles-of-design-thinking |
| 3 | https://www.uxuiopen.com/trial/ux_fundamentals/design_process/ |
| 4 | https://digitalleadership.com/blog/design-thinking/ |
| 5 | https://www.interaction-design.org/literature/topics/design-thinking |
| 6 | https://www.pvpsiddhartha.ac.in/dep_it/lecture%20notes/FDLD_21/UNIT-1.pdf |
| 7 | https://aim.gov.in/pdf/Mentor-DesignThinking.pdf |
| **Access to software and virtual labs: NA** | |
| **Industry articles and case studies:** | |
| 1 | MJV Tecnologia ltda,"Design Thinking_business innovation"e-book |
| 2 | https://theaccidentaldesignthinker.com/2017/09/16/40-design-thinking-success-stories/ |
| 3 | https://voltagecontrol.com/blog/8-great-design-thinking-examples/ |
| 4 | https://online.hbs.edu/blog/post/design-thinking-examples |
| 5 | https://www.theknowledgeacademy.com/blog/design-thinking-case-study/ |
| **Any other (Access to AI tools / Data driven insights (if applicable) or any other):** | |
| 1 | User Research and Sentiment Analysis Tools:CrystalKnows, MonkeyLearn, Clarabridge |
| 2 | User Interviews and Surveys:Affectiva, Surveysparrow |
| 3 | Data Analysis Tools:Tableau, IBM Watson Analytics |
| 4 | Insight Extraction:Sift |
| 5 | Brainstorming and Idea Generation:Miro, Ideaflip, Writeseer |
| 6 | Prototyping Tools:Figma,Sketch2Code, Uizard |
| 7 | User Testing and Feedback:UserTesting, Lookback,Optimal Workshop |
| 8 | Automated Documentation and Note-Taking:Otter.ai,Notion |
| 9 | Collaboration Tools:Slack, Microsoft Teams |

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# Vivekanand Education Society's

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**Internal Assessment:**

Assessment consists of one Mid Term Test of 20 marks and Continuous Assessment of 20 marks.
Mid Term test is to be conducted when approx. 50% syllabus is completed.
Duration of the midterm test shall be one hour.

**Continuous Assessment:**

Continuous Assessment is of **20 marks**. The rubrics for assessment will be considered on approval by the subject teachers. The rubrics can be any 2 or max 4 of the following:

| Sr. No | Rubrics | Marks |
|---|---|---|
| 1 | Certificate course for 4 weeks or more: NPTEL/ Coursera/ Udemy/any MOOC | 10 marks |
| 2 | Wins in the event/competition/hackathon | 10 marks |
| 3 | Content beyond syllabus presentation | 10 marks |
| 4 | Creating Proof of concept | 10 marks |
| 5 | Mini Project | 10 marks |
| 6 | GATE Based Assignment test/Tutorials etc | 10 marks |
| 7 | Participation in event/workshop/talk / competition followed by small report and certificate of participation relevant to the subject (in other institutes) | 05 marks |
| 8. | Multiple Choice Questions (Quiz) | 05 marks |
| 9. | Peer Review and participation the marks can be left blank (with discretion of faculty) | 05 Marks |

| **End Semester Theory Examination:** | |
|---|---|
| 1 | Question paper will be of 60 marks |
| 2 | Question paper will have a total of five questions |
| 3 | All questions have equal weightage and carry 20 marks each |
| 4 | Any three questions out of five needs to be solved. |

**Term Work: 25 marks**

The term work will be based on the Tutorial Performance

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| Course Code | Name of Course | Teaching Scheme (Teaching Hours) | | | Credits Assigned | | | |
|---|---|---|---|---|---|---|---|---|
| | | Theory | Practical | Tutorial | Theory | TW/PR | Tut | Total |
| NMCAE223 | Risk Assessment and management | 03 | --- | 01 | 03 | --- | 01 | 04 |

| Course Code | Name of Course | Examination Scheme | | | | | |
|---|---|---|---|---|---|---|---|
| | | Theory | | | Term Work | Practical & Oral | Total |
| | | Internal Assessment | | End Sem Exam | | | |
| | | Mid-Term Test | Continuous Assessment | | | | |
| NMCAE223 | Risk Assessment and management | 20 | 20 | 60 | 25 | --- | 125 |

| | |
|---|---|
| **Course Prerequisite: Concepts of Software Engineering and Software Project Management** | |
| **Course Objectives:** | |
| 1 | **To study fundamental concept of Risk Analysis** |
| 2 | **Identify characteristics of Risk Management strategy and various approaches to Risk Management.** |
| 3 | **In-depth understanding of the fundamentals of risk assessment and management** |
| 4 | **To understand risk response and its strategies.** |
| 5 | **To identify the risk mitigation strategies.** |
| 6 | **Understand risk monitoring and control strategies.** |
| | |
| **Course Outcomes:** After successful completion of the course students will be able to: | |
| **1** | **Illustrate the fundamentals of Planning and Identifying Risk** |
| **2** | **Identify various Qualitative and Quantitative Risk Analysis Technique** |
| **3** | **describe methods for risk analysis, evaluation and management,** |
| **4** | **Applying various strategies for Planning Risk Response** |
| **5** | **Apply risk mitigation techniques to avoid risk.** |
| **6** | **Make Use of different techniques for Monitoring and Controlling Risk** |
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| Module | Contents | Hrs |
|---|---|---|
| 1 | **Risk Management Process** | 05 |
| | Risk and its Nature, Types of Risk, Process of Risk Management Importance of Risk Management, Risk Management, Perspectives Elements of Software Risk.<br><br>Activities for Tutorials<br>Identify Type of Project Risks<br>Develop Risk Management Plan | |
| 2 | **Risk Identification and Planning** | 08 |
| | Identify Software Risk and Risk Taxonomy, Plan Risk Management, Tools and techniques for Planning Risk Management, Common Software Project Risk, Inputs for Identifying Risk, Tools for Risk Identification, Techniques for Risk Identification<br><br>Activities for Tutorials<br>Identify Techniques for Risk Identification | |
| 3 | **Risk Analysis and Assessment** | 07 |
| | Objectives and Goals of Risk Analysis and Risk Assessment, Qualitative vs Quantitative Risk Analysis, Techniques for Qualitative and Quantitative Risk Analysis, Tools used for Qualitative and Quantitative Risk Analysis, Methods for Risk Assessment<br><br>Activities for Tutorials<br>Perform Qualitative Risk Analysis.<br>Perform Quatiitative Risk Analysis<br>Analyze Risk Assessment method | |
| 4 | **Risk Responses** | 07 |
| | Strategies for Risk Response, Response strategy for Threats Response Strategy for Opportunities, Response, Output of Plan Risk Response | |

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|---|---|---|
| | Activities for Tutorials<br>Identify Response Risk Strategy for Given case study | |
| 5 | **Risk Mitigation Strategies** | 08 |
| | Best practice in risk planning, Risk mitigation strategies:Avoidance strategies ,Risk management tools:Expert tools in risk management, Formulating and implementing risk management plans | |
| 6 | **Monitoring and Controlling Risk** | 04 |
| | Tools for Implementing Risk, Techniques for Implementing Risk Developing a process for Monitoring Risk, formulating a Project Risk Register, Managing and Tracking Risk, Role of Risk Governance and Culture.<br>Activities for Tutorials<br>Perform Risk Monitoring activity<br>Formulate Risk in Project Risk Register<br>Perform Risk Audit | |

| **Tutorials** |
|---|
| Student have to study a case study of any area of interest i.e Healthcare,Aviation,Insurance ets, and perform the above mentioned tutorials. |

| **Textbooks:** | |
|---|---|
| 1 | John Mc Manus" Risk Management in Software Development Projects", Routledge, September 2016. |
| 2 | David Hillson and Peter," Practical Project Risk Management: The ATOM Methodology", Management Concepts ,2nd Edition,2012 |
| **Reference Books:** | |
| 1 | A guide to Project Management Book Of Knowledge", Project Management Institute, Sixth, 2016. |
| 2 | Project Risk Analysis and Management Guide", Association for Project Management, Second, October2015. |

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**Internal Assessment:**

Assessment consists of one Mid Term Test of 20 marks and Continuous Assessment of 20 marks.
Mid Term test is to be conducted when approx. 50% syllabus is completed.
Duration of the midterm test shall be one hour.

**Continuous Assessment:**

Continuous Assessment is of **20 marks**. The rubrics for assessment will be considered on approval by the subject teachers. The rubrics can be any 2 or max 4 of the following:

| Sr. No | Rubrics | Marks |
|---|---|---|
| 1 | Certificate course for 4 weeks or more: NPTEL/ Coursera/ Udemy/any MOOC | 10 marks |
| 2 | Wins in the event/competition/hackathon | 10 marks |
| 3 | Content beyond syllabus presentation | 10 marks |
| 4 | Creating Proof of concept | 10 marks |
| 5 | Mini Project | 10 marks |
| 6 | GATE Based Assignment test/Tutorials etc | 10 marks |
| 7 | Participation in event/workshop/talk / competition followed by small report and certificate of participation relevant to the subject (in other institutes) | 05 marks |
| 8. | Multiple Choice Questions (Quiz) | 05 marks |

| **End Semester Theory Examination:** | |
|---|---|
| 1 | Question paper will be of 60 marks |
| 2 | Question paper will have a total of five questions |
| 3 | All questions have equal weightage and carry 20 marks each |
| 4 | Any three questions out of five need to be solved. |

**Term Work: 25 marks**

The term work will be based on the Tutorial Performance

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| Course Code | Name of Course | Contact Hours | Credits Assigned | Examination Scheme | | | |
|---|---|---|---|---|---|---|---|
| | | | | Term Work | Practical | Oral | Total |
| NMCAL21 | Artificial Intelligence & Machine Learning Lab | 2 | 1 | 25 | 30 | 20 | 75 |

**Prerequisite:** Basic understanding of mathematical, data mining concepts and any programming Language

**Lab Course Objectives:** Course Aims to

| Sr.No. | Course Objective |
|---|---|
| 1 | Understand the problem solving concepts of Artificial Intelligence. |
| 2 | Impart a thorough understanding of basic machine learning algorithms and its applications. |
| 3 | Demonstrate dimensionality reduction techniques for feature extraction and selection. |
| 4 | Build a model using appropriate machine learning algorithms for real world problems. |
| 5 | Build a model using appropriate advanced machine learning algorithms for real world problems |
| 6 | Deployment of model to be learned |

**Lab Course Outcomes:** On the successful completion of the course, students will be able to

| Sr.No. | Outcome | Bloom Level |
|---|---|---|
| CO1 | Demonstrate the basic concepts of Artificial Intelligence and Machine Learning using various libraries in Python. | Applying |
| CO2 | Implement basic Supervised and unsupervised machine learning algorithms and their applications. | Analyzing |
| CO3 | Analyze dimensionality reduction techniques for feature extraction and selection. | Analyzing |
| CO4 | Develop models using Support Vector machines and kernels for real world problems. | Creating |
| CO5 | Develop models using appropriate advanced machine learning algorithms for real world problems. | Creating |
| CO6 | Deploy the machine learning model for real world problems. | Creating |

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**Description:**

| Module | Detailed Contents | Hrs |
|---|---|---|
| **1** | **Introduction to Python Programming:** Learn the different libraries - NumPy, Pandas, SciPy, Matplotlib, and Scikit Learn.<br><br>**Self Learning Topic: -** Milk, Shogun. | 6 |
| **2** | **Supervised Learning:** Apply different machine learning algorithms for prediction like Linear Regression, Logistic Regression, Apriori Classification, KNN-classification.Understand the usage of Confusion Matrix, Precision, Recall<br><br>**Self Learning Topic:** - Evaluation metrics like MSE, Accuracy, ROC curve. | 4 |
| **3** | **Unsupervised Learning:** K-Means Clustering Algorithm, K-Medoid Clustering Algorithm<br><br>**Self Learning Topic:** Other Clustering Algorithms. | 2 |
| **4** | **Classifying data using Support Vector Machines (SVMs):** SVM-RBF kernels.<br><br>**Self Learning Topic**: -SVM-Kernels-Polynomial Kernel | 2 |
| **5** | **Bagging & Boosting Algorithm:** Decision Tree,different ensemble techniques like bagging, boosting, stacking, and voting, Random Forest- bagging, Attribute bagging; and voting for class selection. , AdaBoost, Stochastic Gradient Boosting, Voting Ensemble<br><br>**Self Learning Topic: -** Extra Trees,AdaBoost as a Forward Stage . | 6 |
| **6** | **Dimensionality Reduction:** Features Extraction, Feature selection, Normalization, Transformation, and Principal Components Analysis-visualizations of complex datasets.<br><br>**Self Learning Topic:** - LDA (Linear Discriminant Analysis). | 6 |

**Reference Books**:

| Reference No | Reference Name |
|---|---|
| 1 | Aurelian Géron, Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, 2nd Edition. |
| 2 | Paul J. Deitel, Python Fundamentals. |
| 3 | Stuart Russell, Peter Norvig, ,Artificial Intelligence – A Modern Approach, , Pearson Education / Prentice Hall of India, 3rd Edition, 2009. |

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|---|---|
| 4 | EthemAlpaydn, Introduction to Machine Learning, PHI, Third Edition, ISBN No. 978-81-203- 5078-6. |
| 5 | Peter Harrington, Machine Learning in Action. Manning Publications, April 2012 ISBN 9781617290183. |
| 6 | Introduction to Computer Programming using Python, John V Guttag |
| 7 | Core Python Programming, R. NageswaraRao |


**Web References:**

| Reference No | Reference Name |
|---|---|
| 1 | https://talentsprint.com/pages/artificial-intelligence-machine-learning-iiit-h-program/program-details.pdf |
| 2 | https://learning.oreilly.com/library/view/learning-robotics using/9781783287536/cover.html |
| 3 | http://www.qboticslabs.com |
| 4 | https://subscription.packtpub.com/book/big_data_and_business_intelligence |
| 5 | https://scikit-learn.org/0.16/modules/generated/sklearn.lda.LDA.html |
| 6 | https://machinelearningmastery.com/ensemble-machine-learning-algorithms-python-scikit-learn/ |
| 7 | https://www.coursera.org/learn/machine-learning#syllabus |
| 8 | https://data-flair.training/blogs/python-ml-data-preprocessing/ |

**A suggested list of experiments**

| Practical No | Problem Statement |
|---|---|
| **1** | Introduction to Python Programming:Implementation of NumPy, |
| **2** | Implementation of Pandas for data preprocessing |
| **3** | Implementation of SciPy and Scikit Learn. for machine learning algorithms |
| **4** | Implementation of Matplotlib for data visualization |
| **5** | Implementation of Linear Regression, Logistic regression, KNN- classification. |
| **6** | Implementation of dimensionality reduction techniques: Features Extraction and Selection, Normalization, Transformation, Principal Components Analysis. |
| **7** | Implementation of K-Means and K-medoid clustering algorithm. |

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|---|---|
| **8** | Implementation of classifying data using Support Vector Machines (SVMs). |
| **9** | Implementation of Bagging Algorithm: Decision Tree, Random Forest. |
| **10** | Implementation of Boosting Algorithms: AdaBoost, Stochastic Gradient Boosting, Voting Ensemble. |

| **Term Work:** | |
|---|---|
| 1 | Term work should consist of 10 experiments. |
| 2 | Journal must include at least 2 assignments. |
| 3 | The final certification and acceptance of term work ensures satisfactory performance of laboratory work and minimum passing marks in term work. |
| 4 | Total 25 Marks<br>(Experiments: 15-marks, Attendance Theory & Practical: 05-marks, Assignments: 05-marks) |
| 5 | Based on the subject and related lab of NMCAL21 |

**Term Work: 25 marks**

The term work will be based on the Laboratory work

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| Course Code | Name of Course | Contact Hours | Credits Assigned | Examination Scheme | | | |
|---|---|---|---|---|---|---|---|
| | | | | Term Work | Practical | Oral | Total |
| NMCALE211 | Internet of Things & Industrial Internet of Things Lab | 02 | 01 | 25 | 30 | 20 | 75 |

**Prerequisite**: 1. Knowledge of C and C++ Programming.
2. Basics of Cloud.

**Lab Course Objectives**: Course is aim to

| Sr.No. | Course Objective |
|---|---|
| 1 | Learn basic electronic components and to get familiar with arduino software/hardware. |
| 2 | Learn basic electronic components and get familiar with arduino simulators. |
| 3 | Interface various I/O devices with arduino. |
| 4 | Interface various sensors with arduino. |
| 5 | Interface IoT device with cloud. |
| 6 | Develop skills required to build real-life IoT based projects. |

**Lab Course Outcomes**:

| Sr.No. | Outcome | Bloom Level |
|---|---|---|
| CO1 | Identify basic electronic components and make use of arduino software/hardware. | Applying |
| CO2 | Identify basic electronic components and make use of arduino simulators. | Applying |
| CO3 | Experiment with various I/O devices with Arduino. | Applying |
| CO4 | Experiment with various sensors with Arduino. | Applying |
| CO 5 | Build IoT applications using Cloud. | Creating |
| CO 6 | Develop IoT based projects. | Creating |

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**Description:**

| Module | Detailed Contents | Hrs |
|---|---|---|
| 1 | **Introduction to Basic Components** :<br>Detail working of all the electronics components (resistor ,capacitors,transistor & IDE software Familiarization with Arduino and perform necessary software installation. Breadboard Basics Programming the Arduino<br>o Arduino, circuits, and code: Bringing everything together<br><br>**Self Learning Topics:** Basic electronic components such as LED, resistors, battery etc. | 4 |
| 2 | **Switches, LEDs, and More:**<br>Programs based on interfacing LEDs, Switches/push buttons and Speakers/Buzzer, LCD/ Seven Segment Display with Arduino<br><br>**Self Learning Topics:** Basics of Switches /push buttons , LED, Speakers/Buzzer, LCD/ Seven Segment Display. | 4 |
| 3 | **Analog Values**<br>Programs based on interfacing LEDs, Potentiometer, Photoresistor with Arduino<br>Programs using PWM pins of Arduino<br>Programs using Serial Monitor of Arduino<br>Programs based on interfacing DHT11 temperature sensor<br>Programs based on interfacing Passive infrared sensors (PIR), Ultrasonic of Arduino<br><br>**Self Learning Topics:** Basic of Analog values, PWM concepts | 6 |
| 4 | **Servo Motors:**Programs based on interfacing LEDs, Servo Motor, Potentiometer with Arduino<br><br>**Self Learning Topics:** Basics of servo motors, potentiometer | 2 |
| 5 | **IoT in Cloud:**Interfacing IoT device with Cloud<br><br>**Self Learning Topics:** Computer Network and Cloud Concepts | 4 |
| 6 | **Mini Project:**Mini projects such as Home automation, Robots, Wearable projects, art projects etc.(Remove)<br>**Self Learning Topics:** Real life problem statement | 6 |

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**Reference Books:**

| Reference No. | Reference Name |
|---|---|
| 1 | Make: Learn electronics with Arduino, Jodi Culkin and Eric Hagan, Maker Media |
| 2 | Programming Arduino: Getting started with sketches, Simon Monk , TMH |
| 3 | Getting Started with Arduino: A Beginners Guide, Brad Kendal, |
| 4 | Make: Getting Started with Arduino, Massimo Banzi, Michael Shiloh, Makermedia |
| 5 | Make: Getting Started with Sensors, KimmoKarvinen, TeroKarvinen, Makermedia |
| 6 | Learn Electronics with Arduino, Don Wilcher, Apress |
| 7 | From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence, Jan Holler VlasiosTsiatsis Catherine Mulligan Stefan Aves and StamatisKarnouskos David Boyle |
| 8 | VijayMadisetti and ArshdeepBahga, "Internet of Things (A Hands-on-Approach)", 1 st Edition,VPT, 2014 |
| 9 | The Internet of Things in the Cloud:A Middleware Perspective,By Honbo Zhou |
| 10 | Rethinking the Internet of Things A Scalable Approach to Connecting Everything, Francis daCosta, Apress |

**Web References:**

| Reference No | Reference Name |
|---|---|
| 1 | http://www.tinkercad.com |
| 2 | https://www.arduino.cc/ |
| 3 | https://www.makerspaces.com/15-simple-arduino-uno-breadboard-projects/ |
| 4 | https://thingspeak.com/ |

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Suggested list of experiments:
All Programs to be done using Simulation Tool like Tinkercad or any other simulation tool.
Interfacing IoT devices with the cloud using any cloud platform like ThingSpeak, AWS etc.

| Practical No | Problem Statement |
|---|---|
| 1 | Program to blink Arduino onboard LED and To interface external LED with Arduino and write a program to turn ON LED for 1 sec after every 2 seconds. |
| 2 | To interface 5 LED's with Arduino and write a program to blink 6 LEDs, one at a time, in a back and forth formation. |
| 3 | To interface Push button with Arduino and write a program to turn ON LED when push button is pressed. |
| 4 | To interface Push button, Speaker/buzzer with Arduino and write a program to turn ON LED and generate a note or tone when push button is pressed. |
| 5 | To interface 2 Push buttons, a Speaker with Arduino and write a program to turn ON LED and generate 2 different notes on a two button keyboard. |
| 6 | To interface Seven Segment Display (SSD) with Arduino and write a program to blink SSD. |
| 7 | To interface Seven Segment Display (SSD) with Arduino and write a program to print numbers from 1 to 4 on SSD. |
| 8 | To interface LCD, push button, potentiometer with Arduino and write a program to display a message on the LCD when the push button is pressed. |
| 9 | To interface LCD, push button, potentiometer with Arduino and write a program to display the no. of times (count) the push button is pressed on the LCD. |
| 10 | To interface LEDs, potentiometer with Arduino and write a program to turn on or off more of the LEDs by turning the potentiometer knob. |
| 11 | To interface LED, Photoresistor (LDR) with Arduino and write a program to increase and decrease the brightness of the LED based on the amount of light present. |
| 12 | To interface LEDs with Arduino and write a program to show the fading effect on LED's. |
| 13 | To interface DHT11 sensor with Arduino and write a program to display |

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| | temperature and humidity data on serial monitor. |
| 14 | To interface PIR/ Ultrasonic sensor with Arduino and write a program to turn on and off LED depending on motion detection/sound detection. |
| 15 | To interface servo motor/DC motor with Arduino and write a program to sweep a servo back and forth through its full range of motion/ to control a DC motor. |
| 16 | To interface LED with Arduino and write a program to send sensor data to the cloud using ThingSpeak/ AWS and receive notification. |
| 17 | To interface Temperature sensor with Arduino and write a program to send sensor data to the cloud using ThingSpeak/ AWS and receive notification. |
| 18 | To build a mini project based on interfacing any combination of sensors with Arduino and cloud. |

| **Term Work:** | |
|---|---|
| 1 | Term work should consist of 10 experiments. |
| 2 | Journal must include at least 2 assignments. |
| 3 | The final certification and acceptance of term work ensures satisfactory performance of laboratory work and minimum passing marks in term work. |
| 4 | Total 25 Marks<br>(Experiments: 15-marks, Attendance Theory & Practical: 05-marks, Assignments: 05-marks) |

**Term Work: 25 marks**
The term work will be based on the Laboratory work

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| Course Code | Name of Course | Contact Hours | Credits Assigned | Examination Scheme | | | |
|---|---|---|---|---|---|---|---|
| | | | | Term Work | Practical | Oral | Total |
| NMCALE212 | Design and Analysis of Algorithm Lab | 2 | 1 | 25 | 30 | 20 | 75 |

**Prerequisite:** Basic understanding of mathematical, data mining concepts and any programming Language.

**Lab Course Objectives:** Course Aims to

| Sr.No. | Course Objective |
|---|---|
| 1 | To introduce the methods of designing and analyzing algorithms |
| 2 | Design and implement efficient algorithms for a Divide and Conquer application |
| 3 | Design and implement efficient algorithms for a Greedy approach and Dynamic Programming |
| 4 | Design and implement efficient algorithms for backtracking, branch and bound and string matching algorithms. |
| 5 | Strengthen the ability to identify and apply the suitable algorithm for the given real-world problem. |
| 6 | Analyze worst-case running time of algorithms and understand fundamental algorithmic problems. |

**Lab Course Outcomes:** On the successful completion of the course, students will be able to

| Sr.No. | Outcome | Bloom Level |
|---|---|---|
| CO1 | Implement the algorithms using different approaches. | Applying |
| CO2 | Implement and Analyze the complexities of various algorithms of Divide and Conquer approach | Analyzing |
| CO3 | Implement and Analyze the complexities of Greedy approach and Dynamic Programming | Analyzing |
| CO4 | Implement and Analyze the complexities of backtracking and branch and bound. | Creating |
| CO5 | Implement and Analyze the complexities string matching algorithm | Creating |

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|---|---|---|
| CO6 | .Compare the complexity of the algorithms NP hard Np complete problem | Creating |

**Description:**

| Module | Detailed Contents | Hrs |
|---|---|---|
| 1 | **Introduction**<br>Selection sort, Insertion sort | 4 |
| 2 | **Divide and Conquer Approach**<br>Merge sort, Quick sort, Binary search | 4 |
| 3 | **Greedy Method Approach**<br>Single source shortest path- Dijkstra, Minimum cost spanning trees-Kruskal and Prim‟s algorithm | 5 |
| 4 | **Dynamic Programming Approach**<br>Single source shortest path- Bellman Ford, All pair shortest path- Floyd Warshall, 0/1 knapsack, Longest common subsequence | 5 |
| 5 | **String Matching Algorithms**<br>The Naïve string-matching Algorithms, The Rabin Karp algorithm<br>The Knuth-Morris-Pratt algorithm | 4 |
| 6 | **Backtracking and Branch and bound**<br>N-queen problem, Graph coloring | 4 |

**Reference Books**:


| Reference No | Reference Name |
|---|---|
| 1 | Thomas H.Cormen, Charles E.Leiserson, Ronald L. Rivest and Clifford Stein,—Introduction to Algorithms, Third Edition, PHI Learning Private Limited, 2012 ISBN 978-0-262-03384-8. |
| 2 | AnanyLevitin, —Introduction to the Design and Analysis of Algorithms, Third Edition, Pearson Education, 2012 ISBN 978 0 13 231681 1 |
| 3 | Ellis Horowitz, SartajSahni and SanguthevarRajasekaran - Computer Algorithms/ C++, Second Edition, Universities Press, 2007 ISBN: 9788173716126 |
| 4 | S. Sridhar —Design of Algorithms and Analysis, Oxford university press, 2014. |


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|---|---|
| 5 | Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, ―Data Structures and Algorithms, Pearson Education, Reprint 2006 |
| 6 | Harsh Bhasin, ―Algorithms Design and Analysis, Oxford university press, 2016. |
| 7 | Parag H. Dave, Himanshu B. Dave, "Design and Analysis of Algorithms", 1st Edition, 2008, ISBN: 8177585959, Pearson Education. |


**Web References:**

| Reference No | Reference Name |
|---|---|
| 1 | https://www.javatpoint.com/daa-tutorial |
| 2 | https://www.codechef.com/learn/course/college-design-analysis-algorithms |
| 3 | https://www.geeksforgeeks.org/design-and-analysis-of-algorithms/ |

**A suggested list of experiments**

| Practical No | Problem Statement |
|---|---|
| **1** | Introduction to Python Programming: Learn the different libraries - NumPy, Pandas, SciPy, Matplotlib, Scikit Learn. |
| **2** | Implementation of Linear Regression, Logistic regression, KNN- classification. |
| **3** | Implementation of dimensionality reduction techniques: Features Extraction and Selection, Normalization, Transformation, Principal Components Analysis. |
| **4** | Implementation of K-Means and K-medoid clustering algorithm. |
| **5** | Implementation of classifying data using Support Vector Machines (SVMs). |
| **6** | Implementation of Bagging Algorithm: Decision Tree, Random Forest. |
| **7** | Implementation of Boosting Algorithms: AdaBoost, Stochastic Gradient Boosting, Voting Ensemble. |

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| **Term Work:** | |
|---|---|
| 1 | Term work should consist of 10 experiments. |
| 2 | Journal must include at least 2 assignments. |
| 3 | The final certification and acceptance of term work ensures satisfactory performance of laboratory work and minimum passing marks in term work. |
| 4 | Total 25 Marks<br>(Experiments: 15-marks, Attendance Theory & Practical: 05-marks, Assignments: 05-marks) |

**Term Work: 25 marks**

The term work will be based on the Laboratory work

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| Course Code | Name of Course | Contact Hours | Credits Assigned | Examination Scheme | | | |
|---|---|---|---|---|---|---|---|
| | | | | Term Work | Practical | Oral | Total |
| NMCALE213 | Software Testing & Quality Assurance Lab | 02 | 01 | 25 | 30 | 20 | 75 |

**Prerequisite:** Core Java, Web Technologies like HTML, CSS, XML, XPATH, DOM and JavaScript.

**Lab Course Objectives:** The Course is aim to

| Sr.No. | Course Objective |
|---|---|
| 1 | Understand the basic concepts in Software Testing. |
| 2 | Understand the need for automation |
| 3 | Understand the essential characteristics, requirements and usage of Selenium Web Driver. |
| 4 | Understand the advanced Automation command. |
| 5 | Understand TestNg and automation framework basics. |
| 6 | Understand the basic concepts of software quality assurance. |

**Lab Course Outcomes:** On successful completion of course learner/student will be able to

| Sr.No. | Outcome | Bloom Level |
|---|---|---|
| CO1 | Apply manual software testing techniques to test a software application | Understanding |
| CO2 | Implement Selenium tool to perform automation testing. | Applying |
| CO3 | implement the essential characteristics, requirements and usage of Selenium Web Driver. | Applying |

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|---|---|---|
| **CO4** | Demonstrate the advanced Automation command. | Applying |
| **CO5** | Demonstrate TestiNg and automation framework basics. | Applying |
| **CO6** | implement the basic concepts of software quality assurance. | Applying |

**Description:**

| Module | Detailed Contents | Hrs |
|---|---|---|
| **1** | **Testing Basics** :<br>Study of Review, Construction of Control Flow Graph & Writing Test Cases with case studies. Unit Testing, Integration Testing & System Testing.<br>**Self Learning Topics:** Requirement analysis and derive test scenarios Review of Project Document, Case Study. | **2** |
| **2** | **Introduction to Selenium :**<br>Introduction to automation Testing, Selenium latest version, Installation, Selenium WebDriver First Script.<br>**Self Learning Topics:** Record and run a test case in Selenium IDE | **2** |
| **3** | **Selenium Web Driver Commands :**<br>Implementing Web Drivers on Multiple Browser (chrome, Firefox),handling multiple frames<br>Browser command, navigation Commands and find element command with Example.<br>**Self Learning Topics:** Implementation of web driver on safari | **6** |
| **4** | **Advanced automation Commands :**<br>Locator (id, css selector, Xpath), synchronization in selenium, Handling Alerts using selenium web driver, types of alerts. Action Classes in selenium , Handling Drop Down, List Boxes, Command Button, radio buttons & text boxes.Waits command in selenium.<br>**Self Learning Topics:** Implementation in safari | **6** |
| **5** | **TestNg Framework** :<br>What is testNg? Installing Testng, TestNg Test, writing test cases using testNg, testNg annotation, Testing .xml<br>**Self Learning Topics:** Parameters and dependencies from xml | **8** |

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|---|---|---|
| 6 | **Quality Assurance** :<br>Introduction to software quality assurance, Validation checks and Regression Testing<br>**Self Learning Topics:** Audits, ISO, QMSCase study | 2 |

**Reference Books**:

| Reference No | Reference Name |
|---|---|
| 1 | Software Testing Foundations, 4th Edition: A Study Guide for the Certified Tester Exam (Rocky Nook Computing) Fourth Edition,Andreas Spillner, Tilo Linz and Hans Schaefer. |
| 2 | Selenium WebDriver, Pearson, Rajeev Gupta, ISBN 9789332526297. |
| 3 | Selenium WebDriver Practical Guide - Automated Testing for Web Applications Kindle Edition ,SatyaAvasarala ,ISBN-13: 978-1782168850 |
| 4 | Testng Beginner's Guide, Packt Publishing Ltd.VarunMenon, ISBN 1782166017, 9781782166016 |

**Web References:**

| Reference No | Reference Name |
|---|---|
| 1 | https://www.toolsqa.com/selenium-tutorial/ |
| 2 | https://www.guru99.com/selenium-tutorial.html |
| 3 | https://www.techlistic.com/p/selenium-tutorials.html |

**Suggested list of experiments**

| Practical No | Problem Statement |
|---|---|
| 1 | Take a review and write test cases for any known application. |
| 2 | Implement Web Drivers on Chrome & Firefox Browsers. |

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|---|---|
| 3 | Demonstrate handling multiple frames in selenium |
| 4 | Implement Browser command and navigation Commands. |
| 5 | Implement the find element command |
| 6 | Demonstrate the Locator(id,css selector, path) |
| 7 | Demonstrate synchronization in selenium |
| 8 | Demonstrate different types of alerts |
| 9 | Demonstrate :<br>□ Handling Drop Down,<br>□ List Boxes |
| 10 | Demonstrate<br>□ Command Button,<br>□ Radio buttons & text boxes.<br>□ Waits command in selenium |
| 11 | Demonstrate action classes in Selenium |
| 12 | Installation of TestNg , running testNg and TestNg annotations |
| 13 | Demonstrate Validation testing |
| 14 | Perform regression testing |

| **Term Work:** | |
|---|---|
| 1 | Term work should consist of 10 experiments. |
| 2 | Journal must include at least 2 assignments. |
| 3 | The final certification and acceptance of term work ensures satisfactory performance of laboratory work and minimum passing marks in term work. |

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|---|---|
| 4 | Total 25 Marks<br>(Experiments: 15-marks, Attendance Theory & Practical: 05-marks, Assignments: 05-marks) |
| **Continuous assessment exam** | |
| 1 | Based on the subject and related lab of NMCALE213 |

**Term Work: 25 marks**

The term work will be based on the Laboratory work

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# Vivekanand Education Society's

# Institute of Technology

(An Autonomous Institute Affiliated to University of Mumbai)

| Course Code | Name of Course | Contact Hours | Credits Assigned | Examination Scheme | | | |
|---|---|---|---|---|---|---|---|
| | | | | Term Work | Practical | Oral | Total |
| NMCAL23 | Soft Skills Development Lab | 02 | 01 | 50 | -- | -- | 50 |

**Prerequisite:** Decent working knowledge of the English language (including Grammar) is a must, keeping in mind that most business/management transactions in India and internationally are conducted in the English language

**Lab Course Objectives:** Course aims to

| Sr. No. | Course Objective |
|---|---|
| 1 | Inculcate the essential skills that professionals need to distinguish themselves and make a positive impact on their work and social lives |
| 2 | Provide better understanding of corporate culture and to improve their etiquettes, interpersonal skills and professional image |
| 3 | Develop holistically and ensure comprehensive learning. |
| 4 | Awareness and etiquettes of Written communication skills |
| 5 | Inculcate the skills of facing Interview , group discussion |
| 6 | Provide understanding and ways of Effective Public speaking |

**Lab Course Outcomes:** On successful completion of course learner/student will be able to

| Sr.No. | Outcome | Bloom Level |
|---|---|---|
| CO1 | Develop interpersonal skills that help in communication, teamwork, leadership and decision making. | Applying |
| CO2 | Methodically study, formulate and interpret different facets of organizational behavior and understand the Intercultural sensitivities . | Evaluating |
| CO3 | Develop holistic leaders and technocrats helping in individual and organizational growth. | Creating |
| CO4 | Students will be able to demonstrate Presentation Skills | Applying |

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|---|---|---|
| **CO5** | Develop Business communication and etiquettes of written communication | Applying |
| **CO6** | Develop public speaking skills which help in building confidence. | Creating |

**Description:**

| Module | Detailed Contents | Hrs |
|---|---|---|
| **1** | **Soft Skills Introduction:**<br>Soft-Skills Introduction What are Soft Skills? Significance of Soft-Skills – Soft-Skills Vs. Hard Skills - Selling Soft- Skills – Components of Soft Skills – Identifying and Exhibiting Soft-Skills<br><br>**SelfLearning Topics:** Types of Soft, Hard Skills | **02** |
| **2** | **Communication** :<br>Concept and meaning of communication, methods of communication, verbal and non-verbal communication, techniques to improve communication. Communication in a business organization: Internal (Upward, Downward, Horizontal, Grapevine). External Communication, 7 C's of communication. Active Listening, Differences between Listening and Hearing, Critical Listening, Barriers to Active Listening, Improving Listening, Intercultural sensitivities, Business etiquette when dealing with people from different nationalities<br>Practical (Role plays, case studies)<br><br>**Self LearningTopics :**Problems/Barriers in communication | **03** |
| **3** | **Written/ Business Communication** :<br>Written Communication: Principles of Correspondence, language and style in official letter (full block format, modified block format), Business letters (enquiry to complaints and redressal), Application letter, CV writing, , E- mail etiquette, Documentation of Meetings, Notice, Agenda, Minutes of Meetings.<br>Practical (Practice on CV, Business Letters, Applications, Notice, Agenda, Minutes of Meetings)<br><br>**Self Learning Topics:** Impact of modern Technology on<br>Business Communication the paperless office, use of modern devices | **04** |

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|---|---|---|
| **4** | **Presentation Skills:**<br>Presentation techniques, Planning the presentation, Structure of presentation, Preparation, Evidence and Research, Delivering the presentation, handling questions, Time management. Visual aids.<br>Practical - Presentation by students in groups of maximum 3 on Organizational Behavior topics allocated by faculty.<br>Topics have to cover –<br>1. Personality: Meaning, Personality Determinants, Traits, Personality types and its, impact on career growth,<br>2. Individual / Organizational Decision Making.<br>3. Attitude: Meaning, Components of Attitude, changing attitude and its impact on career growth<br>4. Perception and Values.<br>5. Motivation and Leadership: Concept, Importance.<br>6. Goal setting: SMART (Specific, Measurable, Attainable, Realistic, Timely) Goals, personal and professional goals<br>7. Time and Self-Management.<br>8. Learning in a group, Understanding Work Teams, Dynamics of Group Behavior, Techniques for effective participation<br>9. Etiquette- General & Business Etiquette, Body language<br>10. Emotional intelligence of self and SWOC<br>11. Threats v/s Challenges<br>12. Dos and Don'ts of a presentation/ meetings Online & offline.(presenter & members)<br><br>**Self LearningTopics :** Voice modulation,Tone, Pitch,Knowledge and self confidence | **08** |
| **5** | **Effective Public Speaking** :<br>Public Speaking, Selecting the topic for public speaking, Understanding the audience, Organizing the main ideas, Language and Style choice in the speech, Delivering the speech,Voice Clarity.<br>Practical (Extempore)<br><br>**Self LearningTopics :** Preparation, Attire, Posture and Delivery techniques | **03** |

| | | |
|---|---|---|
| **6** | **Group Discussions:**<br>Group Discussion Skills, Evaluation components, Do's and Don'ts.<br>Practical (Group Discussions)<br><br>**Self LearningTopics: --**Ethics of group Discussion and Debates | **03** |
| **7** | **Interview Techniques:**<br>Interview Techniques, Pre-Interview Preparation, Conduct during interview, Verbal and non-verbal communication, common mistakes. Preparation of CV.<br>Practical (Role plays, mock interviews, Telephonic Interviews, Body Language, Facial Expression)<br><br>**SelfLearningTopics :** Sample communications and exercises, audio-visual presentations | **03** |

**Reference Books**:


| Reference No | Reference Name |
|---|---|
| 1 | Business Communication (Revised Edition), Rai & Rai , Himalaya Publishing House. |
| 2 | Soft skills: an integrated approach to maximise Personality, Chauhan & Sharma,Wiley India publications. |
| 3 | Business Communication: A practice oriented approach, Kalia and ShailjaAgarwal. |
| 4 | Business Communication – Meenakshi Raman, Prakash Singh, Oxford Publication |
| 5 | Stephen Robbins & Judge Timothy: Organization Behavior, Pearson Education |
| 6 | K. Aswathappa – Organizational Behavior: Text, cases & games, Himalaya Publishing House. |
| 7 | Pareek, Udai, Understanding Organizational Behaviour, Oxford University Press, New Delhi. |
| 8 | Taylor & Chandra, "Communication for Business: A Practical Approach," Pearson |
| 9 | Doctor & Doctor, "Business Communication," Sheth Publishers. |


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**Suggested list of experiments**

| Practical No | Problem Statement |
|---|---|
| 1 | Role Plays |
| 2 | Management Activities/Games |
| 3 | Case Studies |
| 4 | Presentations |
| 5 | Extempore Public Speaking |
| 6 | Group Discussions |
| 7 | Mock Interviews |

| **Term Work:** | |
|---|---|
| 1 | Term work should consist of experiments based on business letters, Email etiquettes, written . |
| 2 | Journal must include at least 2 assignments. |
| 3 | The final certification and acceptance of term work ensures satisfactory performance of laboratory work and minimum passing marks in term work. |
| 4 | Total 50 Marks<br>(Experiments/Assignments: 20-marks, Group Presentation :20 Marks Attendance Theory & Practical: 10-marks) |
| **Continuous assessment exam** | |
| 1 | Based on the subject and related lab of NMCAL**23** |

**Term Work: 50 marks**

The term work will be based on the Laboratory work

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# Vivekanand Education Society's

# Institute of Technology

(An Autonomous Institute Affiliated to University of Mumbai)

| Course Code | Name of Course | Contact Hours | Credits Assigned | Examination Scheme | | | |
|---|---|---|---|---|---|---|---|
| | | | | Term Work | Practical | Oral | Total |
| NMCAL24 | DevOps Lab | 04 | 02 | 50 | 30 | 20 | 100 |

**Prerequisite:**Operating System, Linux Administration, Java /Web Application Programming, and Software Engineering

**Lab Course Objectives:**

| Sr.No. | Course Objective |
|---|---|
| 1 | To understand DevOps practices that aim to simplify the Software Development Life Cycle. |
| 2 | To be aware of different Version Control tools. |
| 3 | To familiarize with Jenkins build & test software Applications. |
| 4 | To understand Docker to build, ship, and run containerized images. |
| 5 | To familiarize with the concept of Software Configuration Management. |
| 6 | To familiarize with the concept of Continuous Monitoring. |

**Lab Course Outcomes:**

| Sr.No. | Outcome | Bloom Level |
|---|---|---|
| CO1 | To understand the fundamentals of DevOps engineering and be fully proficient with DevOps terminologies, concepts, benefits, and deployment options | Understanding |
| CO2 | Understand the concepts of different version control tools | Understanding |
| CO3 | Apply Jenkins to Build, Deploy, and Test the Software Applications | Applying |
| CO4 | Analyze & Illustrate the Containerization of OS images and deployment of applications over Docker | Analyzing |

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|---|---|---|
| **CO5** | Deploy and Examine the Software Configuration management using Ansible. | Applying |
| **CO6** | Examine the Software Continuous monitoring using Nagios | Analyzing |

**Description:**

| Sr. No. | Detailed Content | Hours |
|---|---|---|
| 1 | **Introduction to Devops**<br>Concept of DevOps with related technologies which are used to Code, Build, Test, Configure & Monitor the Software Applications.<br>**Self-Learning Topics: Scrum, Agile** | **06** |
| 2 | **Version Control using GIT**<br>GIT Installation, Version Control, working with remote repositories, GIT Cheat sheet, Create and fork repositories in GitHub, apply branching, merging and rebasing concepts, implement different Git workflow strategies in real-time scenarios, Understand Git operations in IDE<br>**Self-Learning Topics: AWS Codecommit** | **08** |
| 3 | **Working with Jenkins and Testing using Selenium**<br>Introduction to Jenkins (With Architecture), Jenkins Management- Adding a slave node to Jenkins, Build the pipeline of jobs using Jenkins, create a pipeline script to deploy an application over the tomcat server using Jenkins, Integrate Selenium with Jenkins and TestNG<br>**Self-Learning Topics: GitLab, AWS CodePipeline** | **10** |
| 4 | **Continuous Deployment: Containerization with Docker**<br>Introduction to Docker with Microservices, Docker Architecture and Container Life Cycle, understanding images and containers, Create and Implement Docker images using Docker file, Container Lifecycle and working with containers, To Build, deploy and manage web or software application on Docker Engine, Publishing image on Docker Hub.<br>**Self-Learning Topics:Docker Compose, Docker Swarm.** | **10** |
| 5 | **Software Configuration Management**<br>Introduction to Software Configuration Management<br>Introduction to Ansible, Installation, Environment, Roles, Commands<br>**Self-Learning Topics: Puppet, Saltstack** | **09** |

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|---|---|---|
| 6 | **Software Continuous Monitoring**<br>Introduction to Continuous Monitoring<br>Introduction to Nagios, Installing Nagios, Nagios Plugins (NRPE) and Objects Nagios Commands and Notification<br>**Self-Learning Topics: Splunk, Snort, Tenable** | **09** |

**Reference Books**:


| Reference No | Reference Name |
|---|---|
| 1 | Prem Kumar Ponuthorai, Jon Loeliger, Version Control with Git, 3rd Edition,O'Reilly Media. |
| 2 | Mastering Jenkins by Jonathan McAllister,Packt Publishing |
| 3 | Sanjeev Sharma and Bernie Coyne,"DevOps for Dummies", Wiley Publication |
| 4 | John Ferguson Smart,"Jenkins, The Definitive Guide", O'Reilly Publication. |
| 5 | Karl Matthias & Sean P. Kane, Docker: Up and Running, O'Reilly Publication. |
| 6 | Russ McKendrick, Learn Ansible, Pakt Publication |
| 7 | Learning Nagios, Packt Publishing |


**Web References:**


| Reference No | Reference Name |
|---|---|
| 1 | https://www.javatpoint.com/devops |
| 2 | https://git-scm.com/docs/gittutorial |
| 3 | https://www.jenkins.io/doc/tutorials/ |
| 4 | https://www.softwaretestinghelp.com/integration-of-jenkins-with-selenium-webdriver/ |
| 5 | https://docs.docker.com/get-started/ |
| 6 | https://docs.ansible.com/ansible/latest/getting_started/index.html |


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|---|---|
| 7 | https://www.guru99.com/nagios-tutorial.html |

**Suggested list of experiments**

| Practical No | Problem Statement |
|---|---|
| 1 | To understand DevOps: Principles, Practices, and DevOps Engineer Role and Responsibilities. |
| 2 | To implement Version control for different files/directories using GIT, install git and create a GitHub account. |
| 3 | To implement version control using GITHUB to sync local GIT repositories and perform various related operations using GIT Cheat-Sheet |
| 4 | To deploy and test Java/web/Python application on Jenkins server |
| 5 | To implement Jenkins pipeline using scripted/declarative pipeline |
| 6 | To use Jenkins to deploy and run test cases for Java/Web application using Selenium/TestNG |
| 7 | To implement Jenkins Master/Slave architecture |
| 8 | To understand Docker with Microservices,Docker Architecture and Container Life Cycle, install Docker and execute docker commands to manage images and interact with containers. |
| 9 | To learn Dockerfile instructions, build an image for a sample web application using Dockerfile. |
| 10 | To implement continuous deployment using Ansible |
| 11 | To implement continuous monitoring using Nagios |

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| Term Work: | |
|---|---|
| 1 | Term work should consist of 10 experiments. |
| 2 | The journal must include at least 2 assignments. |
| 3 | The final certification and acceptance of term work ensures satisfactory performance of laboratory work and minimum passing marks in term work. |
| 4 | Total 50 Marks<br>(Experiments: 30-marks, Attendance Theory & Practical: 10-marks, Assignments: 10-marks) |
| Continuous assessment exam | |
| 1 | Based on the subject and related lab of NMCAL24 |

**Term Work : 50 marks**
The term work will be based on the Laboratory work

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# Vivekanand Education Society's

# Institute of Technology

(An Autonomous Institute Affiliated to University of Mumbai)

| Course Code | Name of Course | Contact Hours | Credits Assigned | Examination Scheme | | | |
|---|---|---|---|---|---|---|---|
| | | | | Term Work | Practical | Oral | Total |
| NMCAL25 | Advanced Data Engineering with Cloud Lab | 02 | 01 | 25 | 30 | 20 | 75 |

**Prerequisite:** Basic Understanding of SQL, Java Programming and Python

**Lab Course Objectives:** -Course is aim to

| Sr.No. | Course Objective |
|---|---|
| 1 | Understand various components of AWS and identify the problem solution |
| 2 | Understand AWS Sagemaker fundamentals for data labeling, bounding boxes and Semantic Segmentation. |
| 3 | Study various data exploration techniques for Data Preprocessing and deploy models after fine tuning.. |
| 4 | Build computer vision model for facial recognition |
| 5 | Build a bot using Natural Language Processing |
| 6 | Apply ChatGPT for the usage of code generation, optimization and debugging |

**Lab Course Outcomes:**

| Sr.No. | Outcomes | Bloom Taxonomy Level |
|---|---|---|
| CO1 | Apply various components of AWS for problem solutions. | Applying |
| CO2 | Apply AWS Sagemaker fundamentals for data labeling, bounding boxes and Semantic Segmentation | Applying |
| CO3 | Apply various data exploration techniques for Data Preprocessing and deploy models after fine tuning. | Creating |
| CO4 | Apply various computer vision techniques for facial recognition. | Applying |
| CO5 | Apply various NLP techniques to create a bot | Creating |
| CO6 | Apply ChatGPT for the usage of code generation, optimization and debugging | Applying |

**Description:**

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| Module No | Detailed Contents | Hrs. |
|---|---|---|
| 1 | **AWS sign up and Service Legal Agreement**: Introduction to real-world problems for project-based Learning, Introduction to AWS sagemaker (Signup, free tier, billing, & IAM), AIML components in AWS, Simple Storage Service (S3) and Elastic Computing Cloud (EC2) Cloudwatch, Billing Alarm.<br><br>**Self-Learning Topics:** Machine Learning challenges. | 4 |
| 2 | **AWS SageMaker:** Data Labeling in AWS Sagemaker Ground Truth, Labeling Text, Bounding Boxes and Semantic Segmentation in Ground Truth.<br><br>**Self-Learning Topics:** Machine Learning pipeline implementation. | 4 |
| 3 | **Data Visualization:** Collecting and securing data, Data Exploring using Amazon SageMaker, evaluating your data, Visualizing Data, Feature engineering Encoding Categorical Variables, training a Model Using Amazon SageMaker,Splitting Data and Training a Model using XGBoost, Hosting and using the model Evaluating the accuracy of the model, Hyperparameter and model tuning.<br><br>**Self-Learning Topics:** Select and Train an algorithm. | 8 |
| **4** | **Forecasting:** Processing time series data using Amazon Forecast-Creating a Forecast with Amazon Forecast, Managed Services for Forecasting.<br><br>**Self-Learning Topics:** Case studies for Forecasting | 2 |
| 5 | **Computer Vision :** Analyzing image and video, Introducing Amazon Rekognition, Preparing custom datasets for computer vision- Labeling images with Amazon Ground Truth, Facial Recognition.<br><br>**Self-Learning Topics:** Computer Vision Applications. | 4 |
| 6 | **Natural Language Processing:** Introduction to Amazon Polly, Amazon Comprend, Amazon Translate, Create a bot to schedule appointments.<br><br>**Self-Learning Topics:** Amazon CodeWhispere | 4 |

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**Reference Books:**

| Reference No | Reference Name |
|---|---|
| 1 | Learning Amazon Web Services (AWS): A Hands-On Guide to the Fundamentals of AWS Cloud by Mark Wilkins 1st Edition, Kindle Edition. |
| 2 | AWS for Beginners: The Complete Beginner's Guide to Learn and Understand Amazon Web Services and Its Future in the Modern World by Vick Middleton. |
| 3 | Mastering AWS Cloud Formation: Plan, develop, and deploy your cloud infrastructure effectively using AWS Cloud Formation by Karen Tovmasyan. |

**Web References:**

| Reference No | Reference Name |
|---|---|
| 1 | https://aws.amazon.com/ |
| 2 | https://aws.amazon.com/sagemaker |
| 3 | https://aws.amazon.com/getting-started/ha |
| 4 | https://aws.amazon.com/sagemaker/da |

**Suggested list of experiments**

| Practical no. | Problem Statement |
|---|---|
| 1 | Introduction to Project Based Learning and understand the problem statements. |
| 2 | Crete login credential and understand SLA, EC2, S3 of AWS. |
| 3 | Introduction to Sagemaker -Labeling data and text and bounding boxes. |
| 4 | Implementation of Exploratory Data Analysis (EDA). |
| 5 | Implementation of Linear and Multiple Linear Regression Analysis. |
| 6 | Implementation of Sagemaker XGBoost Algorithm |
| 7 | Implementation of Optimization strategy |
| 8 | Implementation of Regularization Techniques |
| 9 | Implementation of Classification Algorithms |
| 10 | Study of ChatGPT and Deployment of projects. |

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| Term Work: | |
|---|---|
| 1 | Term work should consist of 10 experiments. |
| 2 | Journal must include at least 2 assignments. |
| 3 | The final certification and acceptance of term work ensures satisfactory performance of laboratory work and minimum passing marks in term work. |
| 4 | Total 25 Marks<br>(Experiments: 15-marks, Attendance Theory & Practical: 05-marks, Assignments: 05-marks) |
| Continuous assessment exam | |
| 1 | Class Project – Select and Train an algorithm |

**Term Work: 25 marks**

The term work will be based on the Laboratory work

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# Vivekanand Education Society's

# Institute of Technology

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| Course Code | Name of Course | Contact Hours | Credits Assigned | Examination Scheme | | | |
|---|---|---|---|---|---|---|---|
| | | | | Term Work | Pract. | Oral | Total |
| NMCAFP21 | Project Stage- 1 | 02 | 01 | 50 | - | -- | 50 |

**Prerequisite: Concept of Project Development and Management**

**Lab Course Objectives:** The course is aimed to

| Sr. No. | Course Objective |
|---|---|
| 1 | To understand and identify the problem statement |
| 2 | Acquaint students with the process of applying basic computer applications and providing solutions to the problems in various application domains.. |
| 3 | Conceptualize knowledge with emphasis on critical thinking and problem-solving skills |
| 4 | Adapt to a rapidly changing environment by having learned and applied new skills. |
| 5 | To apply standard principles of project management and validate the project using appropriate evaluation measures |
| 6 | To inculcate the process of self-learning and research. |

**Lab Course Outcomes:** On successful completion of course learner/student will be able to

| Sr. No. | Course Outcome | Bloom Level |
|---|---|---|
| CO1 | Identify methodology for solving the above problem and apply engineering knowledge and skills to solve it and Use standard norms of engineering practices. | Understanding |
| CO2 | Validate, Verify the results using test cases/benchmark data/theoretical/ inferences/experiments/simulations | Applying |
| CO3 | Analyze and evaluate the impact of solution / product / research / innovation / entrepreneurship towards societal / environmental / sustainable development | Creating |
| CO4 | Design and evaluate solutions for complex problems | Creating |

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|---|---|---|
| CO5 | Communicate through technical report writing and oral presentation. The work may result in research / article / patent / research publication The work may result in business plan for entrepreneurship product created | Understanding |
| CO6 | Gain technical competency by participating in project competitions and Demonstrate capabilities of self-learning, leading to lifelong learning | Applying |

| **Guidelines for Mini Project** | |
|---|---|
| 1 | Mini project may be carried out in one or more form of following: Product preparations, prototype development model, fabrication of set-ups, laboratory experiment development, process modification / development, simulation, software development, integration of software (frontend-backend) and hardware, statistical data analysis, creating awareness in society / environment, research oriented and application areas, etc. |
| 2 | Students shall form a group of 3 students, while forming a group shall not be allowed less than three or more than three students, as it is a group activity. Group will be same till sem III project. |
| 3 | Students should do surveys and identify needs, which shall be converted into problem statements for a mini project in consultation with project mentor / head of the department / internal committee of faculties. |
| 4 | Students shall submit an implementation plan in the form of Gantt / PERT / CPM chart using state-of-the-art industry tools, which will cover weekly activity of mini projects |
| 5 | A logbook may be prepared by each group, wherein the group shall record weekly work progress, project guide shall verify and record notes / comments. |
| 6 | Students under the guidance of the mentor shall convert the best solution into a working model using various components of their domain areas and demonstrate. |
| 7 | The solution to be validated with proper justification and report to be compiled in standard format . Software requirement specification (SRS) documents as per IEEE format, research papers, and competition certificates may be submitted as part of annexure to the report. |
| 8 | With the focus on self-learning, innovation, addressing societal / research / innovation problems and entrepreneurship quality development within the students through the Mini Projects, it is preferable that a single project of appropriate level and quality be carried out in two semesters by all the groups of the students. i.e. Project Stage 1 in semester II. |
| **Term Work** | |

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|---|---|---|
| The review / progress monitoring committee shall be constituted by the head of department. The progress of the mini project to be evaluated on a continuous basis, based on the SRS document and log file activities submitted. Minimum two reviews in each semester | | |
| **Distribution of Term work marks shall be as below:** | | **Marks (25)** |
| 1 | Marks awarded by project mentor based on logbook | 10 |
| 2 | Self-contribution and use of skill set in project | 10 |
| 3 | **Timeliness** of Project report | 05 |
| **II. Project Internal Examination (25 Marks):** | | **Marks (25)** |
| | Marks awarded by review committee/Examiner | 15 |
| | Individual contribution/viva/ communication skills. | 10 |
| Review / progress monitoring committee may consider following points for assessment project as mentioned in general guidelines | | |
| **SEM II Project:** | | |
| In the second semester expected work shall be procurement of component's / systems, building of working prototype, testing and validation of results based on work completed in an earlier semester.<br>● First review is based on readiness of building working prototypes to be conducted.<br>● Second review shall be based on poster presentation cum demonstration of working model in the last month of the said semester. | | |
| **Mini Project shall be assessed based on following point** | | |
| 1 | Clarity of problem and quality of literature Survey for problem identification | |
| 2 | Requirement Gathering via Software Requirement Specification (SRS) / Feasibility Study | |
| 3 | Societal / Research impact | |
| 4 | Novelty, Originality or Innovativeness of project | |
| 5 | Effective use of skill set : Standard engineering practices and Project management standard | |
| 6 | Contribution of an individual's as member or leader | |
| 7 | Completeness of methodology implemented | |

| | |
|---|---|
| 8 | Design, Analysis and Further Plan |
| 9 | Clarity in written and oral communication |
| 10 | Verification and validation of the solution / Test Cases using open source testing tools as per trends in industry |
| 11 | Full functioning of working model as per stated requirements |
| In the second semester evaluation may be based on the above criteria and evaluation of performance of students in mini projects. | |
| **Guidelines for Assessment of Mini Project Practical / Oral Examination** | |
| 1 | Report should be prepared as per the guidelines issued. |
| 2 | The Mini Project shall be assessed through a presentation and demonstration of the working model by the student project group to a panel of Internal /External Examiners preferably from industry/ research organizations having experience of more than five years and academia having experience more than 10 years approved by the head of Institution. |
| 3 | Students shall be motivated to publish a research paper / patent / participate in National / International conferences based on the work. |

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# Vivekanand Education Society's

# Institute of Technology

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## CURRICULUM SCHEME FOR NEP POSTGRADUATE ACADEMIC PROGRAM AT VESIT

## 2024 : Branch: MCA Bridge Course

For the graduates, not having graduation in Computer Science/Information Technology / Computer Application, need to complete the bridge course along with the MCA regular course

| Bridge Course Scheme | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Course Code** | **Name of Course** | **Group** | **Teaching Scheme (Contact Hours)** | | | **Credits Assigned** | | | |
| | | | **Theory** | **Pract.** | **Tut.** | **Theory** | **Pract.** | **Tut** | **Total** |
| NMCABR1 | Object Oriented Methodology with JAVA | ICT | NPTEL/ Udemy Course# | 2 | | -- | -- | -- | --- |
| NMCABR2 | 1.Data Structure with Java<br><br>2.SQL/PLSQL | ICT | NPTEL/ Udemy Course# | 2 | | -- | -- | -- | -- |
| | Total | | | 04 | -- | -- | -- | -- | -- |

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# Vivekanand Education Society's

# Institute of Technology

**(An Autonomous Institute Affiliated to University of Mumbai)**

| Bridge Course Marks Scheme | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Course Code** | **Name of Course** | **Group** | **Examination Scheme** | | | | | | | | |
| | | | **Theory** | | | | | **Pract** | | | |
| | | | **Internal Assessment** | | | **End Sem.** | **Exam. Duration** | **Pract** | **Oral** | **Total** | |
| | | | CA | MT | Tot. | | In Hrs | | | | |
| NMCABR1 | Object Oriented Methodology with JAVA | ICT | Assessment will be according to the NPTEL/Udemy Course weighted for 60 Marks and Performance in Laboratory work. | | | | | 40 | – | 100 | |
| NMCABR2 | 1.Data Structure with Java<br><br>2.SQL/PLSQL | ICT | Assessment will be according to the NPTEL/Udemy Course weighted for 60 Marks and Performance in Laboratory work. | | | | | 40 | – | 100 | |
| | Total | | | | | | | | | 200 | |

**#Course will be Suggested By the Subject Teachers**

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| Course Code | Name of Course | Contact Hours | Credits Assigned | Examination Scheme | | | |
|---|---|---|---|---|---|---|---|
| | | | | Term Work | Practical | Oral | Total |
| NMCABR1 | Object Oriented Methodology with JAVA | **2** | **–** | **–** | **40** | **–** | **40** |

**Reference**


1. The complete reference JAVA2, Herbert schildt. Tata McGraw Hill
2. Programming with Java A Primer, E.Balagurusamy Tata McGraw Hill
3. Core Java for beginners, Sharanam Shah and vaishali shah, SPD
4. Java 6 Programming Black Book, Wiley –Dreamtech
5. Java 6 Programming, Black Book, Dreamtech Press.


**Resource**

1) NPTEL: Programming In Java By Prof. Debasis Samanta | IIT Kharagpur, https://onlinecourses.nptel.ac.in/noc22_cs47/preview
2) Udemy Java Tutorial for Complete Beginners, https://docs.google.com/document/d/1VaCdwUhuoa8wnVxYNbAP65LwjpW6j4TN/editUdemy
3) Udemy: Eclipse IDE for Beginners: Increase Your Java Productivity, https://www.udemy.com/course/luv2code-eclipse-ide-for-beginners/

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**A suggested list of experiments**

| Practical No | Problem Statement |
|---|---|
| **1** | Create a simple Java class (e.g., Person) with attributes (name, age) and methods (display details). Instantiate objects and display their details. |
| **2** | Implement constructors in the Person class, including parameterized and default constructors. Demonstrate constructor overloading. |
| **3** | Create a base class Vehicle with derived classes Car and Bike. Show how inheritance allows sharing of methods and properties. |
| **4** | Extend the Vehicle class and override a method in Car and Bike. Use the super keyword to call the base class method. |
| **5** | Create an abstract class Shape with abstract methods calculateArea() and calculatePerimeter(). Implement these methods in subclasses Circle and Rectangle. |
| **6** | Define an interface Animal with methods sound() and eat(). Implement this interface in classes Dog and Cat. |
| **7** | Demonstrate method overriding and polymorphism by creating a reference of the Animal interface and assigning it to objects of Dog and Cat. |
| **8** | Create a class BankAccount with private fields for account number, balance, and methods to deposit, withdraw, and display balance. Use getter and setter methods. |
| **9** | Write a program that demonstrates handling of different exceptions like ArrayIndexOutOfBoundsException, NullPointerException, and ArithmeticException. |
| **10** | Use ArrayList to store a collection of Student objects. Demonstrate adding, removing, and iterating over the list. |
| **11** | Implement a generic class Box that can store objects of any type. Demonstrate its usage with different types (e.g., Box<Integer>, Box<String>). |

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| Course Code | Name of Course | Contact Hours | Credits Assigned | Examination Scheme | | | |
|---|---|---|---|---|---|---|---|
| | | | | Term Work | Practical | Oral | Total |
| NMCABR2 | Data Structure with Java | **2** | **–** | **–** | **40** | **–** | **40** |

**Reference:**


1. Data Structures and Algorithm Analysis in Java" by Mark Allen Weiss
2. Java Data Structures and Algorithms" by Robert Lafore
3. Data Structures and Algorithms in Java" by Robert Sedgewick and Michael T. Goodrich
4. Introduction to Algorithms" by Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein
5. Java Software Structures: Designing and Using Data Structures" by John Lewis and Joseph Chase


**Resource:**


1. 'Data Structure And Algorithms Using Java" By Prof. Debasis Samanta | IIT Kharagpur. https://onlinecourses.nptel.ac.in/noc22_cs92/preview
2. "Data Structures and Algorithms in Java" by Tim Buchalka https://www.udemy.com/course/data-structures-and-algorithms-deep-dive-using-java/?couponCode=IND21PM
3. Data Structures and Algorithms Specialization, https://www.coursera.org/specializations/data-structures-algorithms


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| Sr.No | Topics of Coverage |
|---|---|
| 1 | Implementation of different sorting techniques.<br>Bubble Sort, Insertion Sort, Selection Sort, Shell Sort, Radix Sort,Quick Sort |
| 2 | Implementation of searching algorithms<br>Linear Search and Binary search |
| 3 | Stack Array implementation, Linked List implementation. |
| 4 | Implementation of Stack Applications like:<br>Postfix evaluation<br>Balancing of Parenthesis |
| 5 | Simple Queue implementation using Linked List<br>Circular Queue implementation using Linked List<br>Double ended Queue<br>implementation using Linked List |
| 6 | Demonstrate application of queue (e.g.. Priority Queue, Breadth First Search) |
| 7 | Implementation of all types of linked List<br>Insert, Display, Delete, Search, Count Reverse operation on<br>● Singly Linked Lists:<br>● Circular Linked List<br>● Doubly Linked Lists |
| 8 | Binary Search Tree Creation and Traversal<br>Operation on BST<br>● Largest Node<br>● Smallest Node<br>● Count number of nodes |
| 9 | Find the minimum spanning tree (using any method Kruskal's Algorithm for Prim's Algorithm) |
| 10 | Implementation of Graph traversal. (DFS and BFS) |
| 11 | Implementation of Min Heap and Max Heap<br>Application : Heap Sort |
| 12 | Demonstrate application of linked list (eg. Polynomial addition, Sparse matrix) |

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| Course Code | Name of Course | Contact Hours | Credits Assigned | Examination Scheme | | | |
|---|---|---|---|---|---|---|---|
| | | | | Term Work | Practical | Oral | Total |
| NMCABR2 | SQL/PLSQL | **2** | **–** | **–** | **40** | **–** | **40** |

## Reference


1. Joel Murach, "Murach'soracle PL/SQL"Joel Murach's publication Murachs and Assocites
2. Sharnam shah, Vaishali Shah, "Oracle forProfessionals"Publication SPD-Shroff
3. Publishers and Distributors 2021
4. RajshekharSundaram, "Oracle 10gProgramming:A Premier", PublicationPearson
5. Education 2009
6. PeterRob and Coronel, "DatabasePrincipals fundamentals of Design,Implementation and Management", Publication CengageLearning 2021.


## Resource

1)Coursera, Oracle SQL Databases Specialization, https://www.coursera.org/specializations/oracle-sql-databases

2)NPTEL: Database Management Systems, Prof. Partha Pratim Das, Department of Computer Science & Engineering, Indian Institute of Technology, Kharagpur

3)Udemy SQL Foundations, https://www.udemy.com/course/sql-essentials-for-beginners/

4)Udemy Introduction to Databases and SQL Querying, https://www.udemy.com/course/introduction-to-databases-and-sql-querying/

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| Sr.No | Topics of Coverage |
|---|---|
| 1 | Data Definition Language: Create, Alter, Drop, Rename,<br>Truncate<br>Data Manipulation Language: Insert, Update, Delete, Select |
| 2 | Not Null, Unique Key, Primary Key, Foreign Key, Check, adding and Dropping a Constraint |
| 3 | Grant, Revoke, Roles, Commit, Rollback, Savepoint |
| 4 | Column Alias, Concatenation Operator, Arithmetic Operators, Comparison Conditions, Logical Conditions, ORDER BY Clause |
| 5 | Single Row Functions, Character Functions, Number Functions,<br>Date Functions, Conversion Functions, Aggregate functions<br>Subquery: Types of Subquery, Group by and Having Clause |
| 6 | Equijoins, Non-Equijoins, Self Joins, Left Outer Joins, Right Outer Joins, Full Outer Joins, Natural Joins |
| 7 | Programming: Variables, Identifiers, Comment, PL/SQL Block Structure<br>IF Statements: Simple IF Statements, Compound IF Statements IF-THEN-ELSE Statements<br>Loop: Basic Loop, WHILE Loop, FOR Loop |
| 8 | Cursor: Types of Cursor, Explicit Cursor Attributes Trigger: Trigger, Statement Trigger, Row Trigger |
| 9 | Create Function, Function with Arguments, Executing Function,<br>Procedures: Block Structure of Subprogram, Types of Subprograms, Procedure with Parameters, Executing Procedures, Dropping Procedures |
| 10 | Packages: Package Specification, Package Body, Creating Package, Execution,Dropping Package |

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