MAR ATHANASIUS COLLEGE(AUTONOMOUS)

KOTHAMANGALAM

CURRICULUM AND SYLLABI FOR

B.VOC PROGRAMME
IN
DATA ANALYTICS AND MACHINE LEARNING

REGULATION, SCHEME AND SYLLABUS

(Under Credit & Semester System)

(2020 ADMISSION ONWARDS)

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SCHEME AND SYLLABUS FOR

B.VOC. DATA ANALYTICS AND MACHINE LEARNING

The University Grants Commission (UGC) had launched a scheme on 27 February, 2014 for skills development based higher education as part of college/university education, leading to Bachelor of Vocation (B.Voc.) degree with multiple entry and exit points. Considering the implementation modalities, the guidelines of the scheme have been revised in the year 2015. The B.Voc. programme is focused on universities and colleges providing undergraduate studies which would also incorporate specific job roles and their NOSs along with broad based general education. This would enable the graduates completing B.Voc to make a meaningful participation in accelerating India's economy by gaining appropriate employment, becoming entrepreneurs and creating appropriate knowledge.

Objectives

1. To provide judicious mix of skills relating to a profession and appropriate content of general education.
2. To ensure that the students have adequate knowledge and skills, so that they are work ready at each exit point of the programme.
3. To provide flexibility to students by means of pre-defined entry and multiple exit points.
4. To integrate NSQF within the undergraduate level of higher education in order to enhance employability of the graduates and meet industry requirements. Such graduates apart from meeting the needs of local and national industry are also expected to be equipped to become part of the global workforce.
5. To provide vertical mobility to students coming out of (a) 10+2 with vocational subjects; and (b) Community Colleges.

Governance and Coordination

An Advisory Committee will be set-up for effective governance and coordination of the courses under the scheme. The Advisory Committee will include the representative(s) of the affiliating university, relevant industries, relevant Sector Skills Council(s), and Nodal Officer of B.Voc Scheme. The Vice Chancellor of the university or his Nominee or Principal of the college, as the case may be, will be the Chairman of the Advisory Committee and the Nodal Officer will be the Member-Secretary. The Committee will meet periodically to review the functioning of the courses, as and when required, but at least once in six months. The Advisory Committee will also ensure the timely submission information to UGC and uploading of data in Skill Development Monitoring System (SDMS). Nodal Officer will submit quarterly progress report to UGC and copy of the same may also be endorsed to Head, Standards & Q.A., National Skill Development Corporation, Block A, Clarion Collection, Shaheed Jeet Singh Marg, New Delhi - 110016.

Assessment

i. The Skill component of the course will be assessed and certified by the respective Sector Skill Councils. In case, there is no Sector Skill Council for a specific trade, the assessment may be done by an allied Sector Council or the Industry partner. The certifying bodies may comply with and obtain accreditation from the National Accreditation Board for Certification Bodies (NABCB) set up under Quality Council of India (QCI). Wherever the university/college may deem fit, it may issue a joint certificate for the course(s) with the respective Sector Skill Council(s).

ii. The credits for the skill component will be awarded in terms of NSQF level certification which will have 60% weightage of total credits of the course in following manner.

Name of the Course	NSQF Level Certificate	Cumulative Credits
Certificate	Level – 4	18 credits
Diploma	Level – 5	36 credits
Advanced Diploma	Level – 6	72 credits
B.Voc Degree	Level – 7	108 credits

iii. The general education component will be assessed by the concerned university as per the prevailing standards and procedures. The following formula may be used for the credit calculation in general education component of the courses:

- General Education credit refers to a unit by which the course work is measured. It determines the number of hours of instructions required per week. One credit is equivalent to one hour of teaching (lecture or tutorial) or two hours of practical work/field work per week. Accordingly, one Credit would mean equivalent of 14-15 periods of 60 minutes each or 28 – 30 hrs of workshops / labs.
- For internship / field work, the credit weightage for equivalent hours shall be 50% of that for lectures / tutorials.
- For self-learning, based on e-content or otherwise, the credit weightage for equivalent hours of study shall be 50% of that for lectures / tutorials.

a. Letter grades and grade points

Letter Grades and Grade Points

The UGC recommends a 10-point grading system with the following Letter grades as given below:

Letter Grade	Grade Point
O (Outstanding)	10
A^+ (Excellent)	9

A (Very Good)	8
B^+ (Good)	7
B (Above Average)	6
C (Average)	5
P (Pass)	4
F (Fail)	0
Ab (Absent)	0

A student obtaining Grade F shall be considered failed and will be required to reappear in the examination.

Computation of SGPA and CGPA

Following procedure to compute the Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA) may be adopted:

- The SGPA is the ratio of sum of the product of the number of credits with the grade points scored by a student in all the course components taken by a student and the sum of the number of credits of all the courses undergone by a student in a semester,

ie;

$$\textbf{SGPA}\ (Si) = \Sigma(Ci \times Gi) / \Sigma Ci$$

Where, 'Ci' is the number of credits of the i^{th} course component and 'Gi' is the grade point scored by the student in the i^{th} course component.

- The CGPA is also calculated in the same manner taking into account all the courses undergone by a student over all the semesters of a programme,

$$ie;\ \textbf{CGPA} = \Sigma\ (Ci \times Si) / \Sigma\ Ci$$

Where 'Si' is the SGPA of the i^{th} semester and 'Ci' is the total number of credits in that semester.

- The SGPA and CGPA shall be rounded off to 2 decimal points and reported in the transcripts.

[*]*Reference: UGC B.Voc. Guidelines*

GRADUATE ATTRIBUTES

Job Roles proposed to be covered in each year (Along with NSQF level)

Semester / Year	NSQF Level
First Semester	**Level 4** 1. Domestic Data Entry Operator NOS REFERENCE ID: SSC/Q2212 Maintain proper entry of required data of customers through use of various data entry softwares and techniques. 2. Collections Executive NOS REFERENCE ID: SSC/Q2214 Individuals in this job are responsible for reconciliation of customer accounts through payment follow ups, sending payment reminders, investigating and solving customers' problems, which may lead to delay in payments, communicate the right information to the customers. 3. Domestic IT Helpdesk Attendant NOS REFERENCE ID: SSC/Q0110 Managing and resolving client queries / issues primarily through telephonic calls. • Statistical Enumerator: Statistical Data Collection and preprocessing tasks. • Office Assistant : Administrative tasks, word processing jobs and maintaining records in an office. • DTP Operators :Operates office equipment such as printers, copy machines. • Akshaya e-centre personnel :Giving e-literacy training to ASHA worker, Anganvadi worker etc.
Year I	**Level 5** • Associate: Customer Relationship Management NOS REFERENCE ID: SSC/Q2202 Individuals in this job receive and make telephone calls which are primarily scripted, basic and routine with the assistance of a computerized system. They answer inquiries, resolve problems, record complaints and/or receive feedback. • Associate – Recruitment NOS REFERENCE ID: SSC/Q2501 Individuals at this job are responsible for supporting recruitment

	activities such as candidate management, first level screening, scheduling and coordination and headhunting. • Technical Support Executive-Non Voice NOS REFERENCE ID: SSC/Q7201 Individuals at this job are responsible for resolving queries and customer cases over web-chat or email. • Associate-Customer Care (Non-Voice) NOS REFERENCE ID: SSC/Q2201 Individuals at this job are responsible for resolving queries and customer cases over web-chat or email. • Technical Writer NOS REFERENCE ID: SSC/Q0505 Individuals at this job are responsible for creating technical documentation related to an application like job-aids, help documents and training materials. These documents serve the core purpose of transferring knowledge between the application development teams and the user teams. The information may be presented in the form of user guides for software applications, reference manuals, training guides or online help incorporated into software and operating guides. • Statistical Investigator: Statistical Data Collection and analyses tasks. • Data Analyst.
Year-II	**Level 6** 1. AI - Data Quality Analyst NOS REFERENCE ID: SSC/Q8101 Individuals at this job are responsible for performing different aspects of data quality management. S/he will be responsible for importing and preprocessing data as per pre-defined specifications or as desired for analysis. 2. AI - Business Intelligence Analyst NOS REFERENCE ID: SSC/Q8102 Individuals at this job are responsible for performing different aspects of Business Analysis. S/he will be responsible for importing and preprocessing data and perform exploratory

	analysis to derive actionable insights. 3. AI - Visualization Specialist NOS REFERENCE ID: SSC/Q8103 Individuals at this job are responsible for performing different aspects of visualization. S/he will be responsible for creating reports, charts and dashboards using appropriate visualization tools. S/he will also ensure that the desired output is available across different formats based on the needs of various users. • Business Process Outsourcer: Enable to undertake and carry out data processing activities in computerized environments. Analyze business operations, trends, costs, revenues, financial commitments.
Year-III	**Level 7** 1. AI - Test Engineer NOS REFERENCE ID: SSC/Q8116 Individuals at this job are responsible for performing different aspects of product testing. S/he will be responsible for developing test cases and simulations for end-to-end testing and QA of hardware and software systems. 2. AI - Data Steward NOS REFERENCE ID: SSC/Q8111 Individuals at this job are responsible for defining data standards, assessing quality, completeness and timeliness of data. They are also responsible for implementing good data governance processes and practices. 3. Technical Writer NOS REFERENCE ID: SSC/Q4501 Individuals at this job are responsible for creating technical documentation related to an application like job-aids, help documents and training materials. These documents serve the core purpose of transferring knowledge between the application development teams and the user teams. The information may be presented in the form of user guides for software applications, reference manuals, training guides or online help incorporated into software and operating guides. 4. Junior Data Associate NOS REFERENCE ID: SSC/Q0401

	Individuals at this job are responsible for designing and implementing processes and layouts for complex, large-scale data sets used for modeling, data mining, and research purposes. Responsibilities also include designing and implementing statistical data quality procedures around new data sources. 5. AI - Machine Learning Engineer NOS REFERENCE ID: SSC/Q8113 Individuals at this job are responsible for developing applications and platforms in AI & Big Data Analytics. S/he will be responsible for developing software code to deploy algorithmic models as per the needs of the business and evaluating the technical performance of the same. 6. AI - Applied Scientist NOS REFERENCE ID: SSC/Q8105 Individuals at this job are responsible for performing different aspects of data science. S/he will be responsible for importing and preprocessing data, performing exploratory analysis and applying pre-designed algorithmic models for various use cases/scenarios. 7. AI - Data Engineer NOS REFERENCE ID: SSC/Q8106 Individuals at this job are responsible for working on different aspects of data architecture. S/he will be responsible for developing data integrations. 8. AI - Database Administrator NOS REFERENCE ID: SSC/Q8109 Individuals at this job are responsible for performing different aspects of administration and governance. S/he will be responsible for creating and maintaining databases. • Entrepreneurship: Pursue self-employable opportunities in business process services. • Data Analyst: Can carry out Statistical Data Analysis activities

AIMS AND OBJECTIVES

Data Science is a multi-disciplinary field that utilizes logical techniques, procedures, calculations and

frameworks to separate information and bits of knowledge from organized and unstructured data. Data Science is an idea to bind together Statistics, data investigation, AI and their related techniques so as to understand and analyse the actual phenomena within the data. It utilizes procedures and hypotheses drawn from numerous fields inside the setting of Mathematics, Statistics, Computer Science and Information science. Turing award winner Jim Gray envisioned Data Science as a "fourth paradigm" of science. Data Science, as a field of study is making a boom all over the world. It is being applied on every aspects of life. Newer domains of applications are being found out. All these points out to the importance of getting knowledge in Data Science concepts for a job aspirant student.

The proposed vocational programme in Data Analytics and Machine Learning will be a judicious mix of skills, professional education related to Data Analytics and Machine Learning and also appropriate content of general education. It is designed with the objective of equipping the students to cope with the emerging trends and challenges in the field of Data Analytics and Machine Learning.

PROGRAMME DESIGN

As per the UGC guidelines, there are multiple exit points for a candidate admitted in this course. If he/she is completing all the six credits successfully, he/she will get B. Voc. Degree in Data Analytics and Machine Learning. If he/she is completing the first four semesters successfully, he/she will get an Advanced Diploma in Data Analytics and Machine Learning. If he/she is completing the first two semesters successfully, he/she will get a Diploma in Data Analytics and Machine Learning. If he/she is completing the first one semester successfully, he/she will complete a Certificate Course in Data Analytics and Machine Learning.

Cumulative credits awarded to the learners in skill based vocational courses.

NSQF Level/Year	Skill Component Credits	General Component Credits	Normal Duration	Exit Points / Awards
Level 7/Year 3	108	72	Six Semesters	B. Voc. Degree
Level 6/Year 2	72	48	Four Semesters	Advanced Diploma
Level 5/Year 1	36	24	Two Semesters	Diploma
Level 4/6 Months	18	12	One Semester	Certificate Course

The curriculum in each of the years of the programme would be a suitable mix of general education and skill development components. As is evident from Table above, the General Education Component shall have 40 % of the total credits and balance 60% credits will be of Skill Component. The Curriculum details should be finalized before introduction of the courses.

COURSE CODE FORMAT

A nine-character Course code is assigned to each course. The first character indicates the discipline, second, third and fourth character indicates the programme, fifth and sixth specifies types of course category, seventh for semester and next two characters for serial no of the course

Eg: **VDAMCC101**

- V: Vocational
- DAM: Data Analytics and Machine Learning
- CC/GC/SC: Common Course/ General Component/ Skill Component
- 1: Semester
- 01: Serial Number of the Course

NATURE OF THE COURSE

i. No open course is envisaged
ii. No Electives are included
iii. Total credits is 180
iv. Working hours per week is 30 hours
v. All vocational subjects are treated as core course
vi. Multiple exit points are permitted.
vii. A candidate who failed in a semester may get two supplementary chances. Only failed papers are to be written in the supplementary examination.

PROGRAMME STRUCTURE

a) Title

Regulations for conducting B. Voc Programme under Mahatma Gandhi University

b) Scope

The regulations stated in this document shall apply to all B.Voc Programmes conducted by colleges affiliated to Mahatma Gandhi University, sanctioned by University Grants Commission with effect from 2014 admission.

c) Definitions

B.Voc: Bachelor of Vocation- is a scheme introduced by UGC for skill development based higher education as part of college/university education.

NSQF : National Skills Qualifications Framework

Programme: A Programme refers to the entire course of study and examinations for the award of the B. Voc degree.

Semester: A term consisting of a minimum of 450 contact hours distributed over 90 working days, inclusive of examination days, within 18 five- day academic weeks.

Course: Refers to the conventional paper, which is portion of the subject matter to be covered in a semester. A semester shall contain many such courses from general and skill development areas.

Credit: B. Voc programme follows a credit semester system and each Course has an associated credit.

Grade: Uses seven point grading system suggested by Hrdayakumari Commission to assess the students.

Words and expressions used and not defined in this regulation shall have the same meaning assigned to them in the Act and Statutes.

Eligibility for Admission

Eligibility for admissions and reservation of seats for B.Voc Data Analytics and Machine Learning shall be according to the rules that no student shall be eligible for admission to B.Voc Data Analytics and Machine Learning unless he/she has successfully completed the examination conducted by a Board/ University at the +2 level of schooling in Mathematics stream. The total no.of seats allotted is 30.

The B.Voc. Data Analytics and Machine Learning shall include:

a) Language courses
b) General Education Components
c) Skill Components
d) Internship
e) Field Visits
f) Project
g) Soft Skills and Personality Development Programmes
h) Study tours

B.Voc Data Analytics and Machine Learning

A	Program Duaration	6 Semesters
B	Total Credits required for successful completion of the Programme	180
C	Credits required from Common Course I	24
D	Credits required from Skill course and General courses including Project	156
E	Minimum attendance required	75%

SCHEMES OF COURSES

Sl. No.	Courses	No. of Papers	Credits
1.	General Education Components (+ Common Courses)	18	72
2.	Skill Components	27	99
3.	Project	1	5
4.	Internship	1	4
Total		**47**	**180**

DURATION OF THE COURSE

- The duration of U.G. Programmes shall be 6 semesters. Each semester shall have 90 working days inclusive of all examinations.
- A student may be permitted to complete the programme, on valid reasons, within a period of 12 continuous semesters from the date of commencement of the first semester of the programme.
- Attendance: Students having a minimum of 75% average attendance for all the courses only, can register for the examination.

Readmission

Readmission will be allowed as per the prevailing rules and regulations of the university.

There shall be 3 level monitoring committees for the successful conduct of the scheme. They are:

1. Department Level Monitoring Committee (DLMC),comprising HOD and two senior-most teachers as members.
2. College Level Monitoring Committee (CLMC),comprising Principal, Dept. Co – Ordinator and A.O/Superintendent as members.
3. University Level Monitoring Committee (ULMC),headed by the Vice – Chancellor and Pro –Vice – Chancellor ,Convenors of Syndicate subcommittees on Examination, Academic Affairs and Staff and Registrar as members and the Controller of Examinations as member-secretary.

EXAMINATIONS

The evaluation of each course shall contain two parts:

(i) Internal or In-Semester Assessment (ISA)
(ii) External or End-Semester Assessment (ESA)

- The internal to external assessment ratio shall be 1:4.
- Both internal and external marks are to be rounded to the next integer.
- Grades are given **on a 7-point scale** based on the total Percentage of marks,

(ISA+ESA) as given below: -

Percentage of Marks	**Grade**	**Grade Point**
95 and above	S Outstanding	10
85 to below 95	A^+ Excellent	9
75 to below 85	A Very Good	8
65 to below 75	B^+ Good	7
55 to below 65	B Above Average	6
45 to below 55	C Satisfactory	5
35 to below 45	D Pass	4
Below 35	F Failure	0
	Ab Absent	0

Note: Decimal are to be rounded to the next whole number

CREDIT POINT AND CREDIT POINT AVERAGE

Credit Point (CP) of a course is calculated using the formula

CP = C × GP, where C = Credit; GP = Grade point

Semester Grade Point Average (SGPA) of a Semester is calculated using the formula: -
SGPA = TCP/TC, where TCP is the Total Credit Point of that semester.

Cumulative Grade Point Average (CGPA) is calculated using the formula: -
CGPA = TCP/TC, where TCP is the Total Credit Point of that programme.

Grade Point Average (GPA) of different category of courses viz. Common Course I, Common Course II, Complementary Course I, Complementary Course II, Vocational course, Core Course is calculated using the formula: -

GPA = TCP/TC, where TCP is the Total Credit Point of a category of course. TC is the total credit of that category of course

Grades for the different courses, semesters and overall programme are given based on the corresponding CPA.

CPA

GPA	Grade
9.5 and above	**S Outstanding**
8.5 to below 9.5	**A+ Excellent**
7.5 to below 8.5	**A Very Good**
6.5 to below 7.5	**B+ Good**
5.5 to below 6.5	**B Above Average**
4.5 to below 5.5	**C Satisfactory**
3.5 to below 4.5	**D Pass**
Below 3.5	**F Failure**

MARKS DISTRIBUTION FOR EXTERNAL AND INTERNAL EVALUATIONS

The external theory examination of all semesters shall be conducted by the College at the end of each semester. Internal evaluation is to be done by continuous assessment. For all courses without practical total marks of external examination is 80 and total marks of internal evaluation is 20. Marks

distribution for external and internal assessments and the components for internal evaluation with their marks are shown below:

For all Theory Courses

1) **Marks of external Examination: 80**
2) **Marks of internal evaluation: 20**

Components of Internal Evaluation–Theory	**Marks**
Attendance	5
Assignment/Seminar/Viva	5
Test paper (s)(1or2) (1×10=10;2×5=10)	10
Total	20

For all Practical Courses total marks for external evaluation is 80 and total marks for internal evaluation is 20.

For all Practical Courses

a) Marks of external Examination : 80
b) Marks of internal evaluation : 20

Components of Internal Evaluation–Practical	**Marks**
Attendance	5
Record	5
Skill Test	5
Lab Performance / Punctuality	5
Total	20

*Marks awarded for Record should be related to number of experiments recorded and duly signed by the teacher concerned in charge.

All three components of internal assessments are mandatory.

PROJECT EVALUATION

a) Marks of external Examination : 80
b) Marks of internal evaluation : 20

Components of Internal Evaluation	Marks
Punctuality	5
Experimentation/Data Collection	5
Skill Acquired	5
Report	5
Total	**20**

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Components of External Evaluation	Marks
Dissertation (External)	50
Viva-Voce (External)	30
Total	**80**

(Decimals are to be rounded to the next higher whole number)

INTERNSHIP

After the completion of fourth semester, the student will undergo Internship Programme in an Industry, having a good exposure in the concerned skill (Established at least two years prior), capable of delivering the skill sets to the students.

At the end of the Internship, the students should prepare a comprehensive report.

Attendance Evaluation for all papers

Attendance Percentage	Marks
Lessthan75%	1Mark

75%&lessthan80%	2Marks
80%&lessthan85%	3Marks
85%&lessthan90%	4Marks
90%&above	5Marks

(Decimals are to be rounded to the next higher whole number)

ASSIGNMENTS

Assignments are to be done from 1st to 4th Semesters. At least one assignment per course per semester should be submitted for evaluation.

INTERNAL ASSESSMENT TEST PAPERS

Two test papers are to be conducted in each semester for each course. The evaluations of all components are to be published and are to be acknowledged by the candidates. All documents of internal assessments are to be kept in the college for one year and shall be made available for verification by the University. The responsibility of evaluating the internal assessment is vested on the teacher(s), who teach the course.

GRIEVANCE REDRESSAL MECHANISM

Internal assessment shall not be used as a tool for personal or other type of vengeance. A student has all rights to know, how the teacher arrived at the marks. In order to address the grievance of students, a three-level Grievance Redressal mechanism is envisaged. A student can approach the upper level only if grievance is not addressed at the lower level.

Level 1: Department Level:

The Department cell chaired by the Nodal Officer/HOD, Department Coordinator, Faculty Advisor and Teacher in-charge as members.

Level 2: **College level**

A committee with the Principal as Chairman, College Coordinator, HOD of concerned Department and Department Coordinator as members.

Level 3: **University Level**

A Committee constituted by the Vice-Chancellor as Chairman, Pro-Vice-Chancellor, Convener - Syndicate Standing Committee on Students Discipline and Welfare, Chairman- Board of Examinations as members and the Controller of Examination as

member- secretary.

The College Council shall nominate a Senior Teacher as coordinator of internal evaluations. This coordinator shall make arrangements for giving awareness of the internal evaluation components to students immediately after commencement of I semester

The internal evaluation marks/grades in the prescribed format should reach the University before the 4th week of October and March in every academic year.

EXTERNAL EXAMINATION

The external examination of all semesters shall be conducted by the University at the end of each semester.

- Students having a minimum of 75% average attendance for all the courses only can register for the examination. Condonation of shortage of attendance to a maximum of 10 days in a semester subject to a maximum of 2 times during the whole period of the programme may be granted by the University on valid grounds. This condonation shall not be counted for internal assessment. Benefit of attendance may be granted to students attending University/College union/Co-curricular activities by treating them as present for the days of absence, on production of participation/attendance certificates, within one week, from competent authorities and endorsed by the Head of the institution. This is limited to a maximum of 10 days per semester and this benefit shall be considered for internal assessment also. Those students who are not eligible even with condonation of shortage of attendance shall repeat the **semester** along with the next batch after obtaining readmission.
- Benefit of attendance may be granted to students attending University/College union/Co- curricular activities by treating them as present for the days of absence, on production of participation/attendance certificates, within one week, from competent authorities and endorsed by the Head of the institution. This is limited to a maximum of 10 days per semester and this benefit shall be considered for internal assessment also.
- Those students who are not eligible even with condonation of shortage of attendance shall repeat the course along with the next batch.
- There will be no supplementary exams. For reappearance/ improvement, the students can appear along with the next batch.
- Student who registers his/her name for the external exam for a semester will be eligible for promotion to the next semester.
- A student who has completed the entire curriculum requirement, but could not register for the Semester examination can register notionally, for getting eligibility for promotion to the next semester.
- A candidate who has not secured minimum marks/credits in internal examinations can re-do the same registering along with the University examination for the same semester, subsequently.

PATTERN OF QUESTIONS

Questions shall be set to assess knowledge acquired, standard and application of knowledge, application of knowledge in new situations, critical evaluation of knowledge and the ability to synthesize knowledge. The question setter shall ensure that questions covering all skills are set. She/he shall also submit a detailed scheme of evaluation along with the question paper. A question paper shall be a judicious mix of short answer type, short essay type /problem solving type and long essay type questions.

Pattern of questions for External examination–Theory paper

Question Type	Total no. of questions	Number of questions to be answered	Marks of each question	Total marks
Very short answer type	12	10	2	20
Short answer(Not to exceed 60 words)	9	6	5	30
Long essay	4	2	15	30
TOTAL	**25**	**18**		**80**

Pattern of questions for external examination with Practical

Question Type	Total no. of questions	Number of questions to be answered	Marks of each question	Total marks
Theory Assessment- Short Answer Type	8	5	4	20
Skill Assessment- Practical	1	1	60	60
TOTAL	**9**	**6**		**80**

Mark division for external LAB examination

Record	Theory/ Procedure/ Design	Activity/ Neatness	Result	Viva	Total
10	10	20	10	10	60

PROGRAMME STRUCTURE

Semester - I					
Sl. No.	Course Code	Title	GC/SC/CC	Hrs/Week	Credits
1	VGENCC101	Listening And Speaking Skills In English	CC	4	4
2	VDAMGC101	Introduction to IT	GC	4	4
3	VDAMGC102	Calculus & Real Analysis	GC	4	4
4	VDAMSC103	Descriptive Statistics-I	SC	4	4
5	VDAMSC104	Introduction to Python Programming	SC	4	4
6	VDAMSC105	Softwares for Statistics	SC	3	3
7	VDAMSC106	Python Lab	SC-Practical	4	4
8	VDAMSC107	Software Lab	SC-Practical	3	3

Semester - II					
Sl.No.	Course Code	Title	CC/GC/SC	Hrs/Week	Credits
1	VGENCC201	Reading Skills	CC	4	4
2	VDAMGC201	Introduction to DBMS	GC	4	4
3	VDAMGC202	Linear Algebra-I	GC	4	4
4	VDAMSC203	Introduction to R Programming	SC	4	4
5	VDAMSC204	Statistical Inference	SC	4	4
6	VDAMSC205	Statistical Distributions	SC	4	4
7	VDAMSC206	R Lab	SC-Practical	3	3
8	VDAMSC207	DBMS Lab	SC-Practical	3	3

Semester - III					
Sl. No.	Course Code	Title	CC/GC/SC	Hrs/Week	Credits
1	VGENCC301	Writing and Presentation Skills	CC	4	4
2	VDAMGC301	Enterprise Resource Planning	GC	4	4
3	VDAMGC302	Linear Algebra-II	GC	4	4
4	VDAMSC303	Advanced Python Programming	SC	4	4
5	VDAMSC304	Advanced R Programming	SC	4	4
6	VDAMSC305	Multivariate Analysis	SC	4	4
7	VDAMSC306	Advanced Python Lab	SC-Practical	3	3
8	VDAMSC307	Advanced R Lab	SC-Practical	3	3

Semester - IV					
Sl. No.	Course Code	Title	CC/GC/SC	Hrs/Week	Credits
1	VGENCC401	Soft Skills& Personality Development	CC	4	4
2	VDAMGC401	Business Ethics	GC	4	4
3	VDAMGC402	Fuzzy Mathematics	GC	4	4
4	VDAMSC403	Sampling & Design of Experiments	SC	4	4
5	VDAMSC404	Time Series	SC	4	4
6	VDAMSC405	Machine Learning I	SC	4	4
7	VDAMSC406	Python Lab	SC-Practical	3	3
8	VDAMSC407	R Lab	SC-Practical	3	3

Semester - V					
Sl. No.	Course Code	Title	CC/GC/SC	Hrs/Week	Credits
1	VGENCC501	Environmental Studies	CC	4	4
2	VDAMGC501	Business Informatics	GC	4	4
3	VDAMGC502	Operations Research-1& Numerical Methods	GC	4	4
4	VDAMSC503	Introduction to Big Data	SC	4	4
5	VDAMSC504	Machine Learning II	SC	4	4
6	VDAMSC505	Internship	SC-Practical	4	4
7	VDAMSC506	Python Lab	SC-Practical	3	3
8	VDAMSC507	R Lab	SC-Practical	3	3

Semester - VI					
Sl. No.	Course Code	Title	CC/GC/SC	Hrs/Week	Credits
1	VGENCC601	Entrepreneurship Development Program	CC	4	4
	VDAMGC601	Principles of Management	GC	4	4
2	VDAMGC602	Operations Research-II	GC	4	4
3	VDAMSC603	Advanced topics in Deep learning	SC	5	5
4	VDAMSC604	Data Mining Concepts	SC	4	4
5	VDAMSC605	Project	SC	5	5
6	VDAMSC606	Lab	SC	4	4

GC – General Component

SC - Skill Component

CC-Common Course

B.Voc. in Data Analytics and Machine Learning

Detailed Syllabus

SEMESTER I

VGENCC101- Listening And Speaking Skills In English

CREDITS : 4
TOTAL LECTURE HOURS : 4 HOURS/WEEK

Module 1

Speech Sounds: Phonemic symbols – Vowels – Consonants – Syllables – Word stress – Stress in polysyllabic words – Stress in words used as different parts of speech – Sentence stress – Weak forms and strong forms – Intonation

Sample activities:

1. Practice reading aloud. Use a variety of texts including short stories, advertisement matter, brochures, etc
2. Read out a passage and ask the students to identify the stressed and unstressed syllables.

Module 2

Basic Grammar: Articles - Nouns and prepositions - Subject-verb agreement -

Phrasal verbs - Modals - Tenses - Conditionals – Prefixes and suffixes – Prepositions - Adverbs
– Relative pronouns - Passives - Conjunctions - Embedded questions - Punctuation – Abbreviations-concord- collocations-phrasal verbs- idiomatic phrases

Sample activities:

- Ask students to write a story/report/brochure, paying attention to the grammar.

Module 3

Listening: Active listening – Barriers to listening – Listening and note taking – Listening to announcements – Listening to news on the radio and television.

Sample activities:

1. Information gap activities (e.g. listen to a song and fill in the blanks in the lyrics given on a sheet)
2. Listen to BBC news/ a play (without visuals) and ask the students to report what they heard.

Module 4

Speaking- Fluency and pace of delivery – Art of small talk – Participating in conversations – Making a short formal speech – Describing people, place, events and things – Group discussion skills, interview skills and telephone skills.

Sample activities:

1. Conduct group discussion on issues on contemporary relevance.
2. Ask students to go around the campus and talk to people in the canteen, labs, other departments etc. and make new acquaintances.

References

1. *English for Effective Communication*. Oxford University Press, 2013.
2. Marks, Jonathan. *English Pronunciation in Use*. New Delhi: CUP, 2007.

3. Lynch, Tony. *Study Listening.* New Delhi:CUP, 2008.

VDAMGC101-Introduction to IT

CREDITS : 4
TOTAL LECTURE HOURS : 4 HOURS/WEEK

Module 1

Computer characteristics: Speed, storage, accuracy, diligence; Digital signals, Binary System, ASCII; Historic Evolution of Computers; Classification of computers: Microcomputer, Minicomputer, mainframes, Supercomputers; Personal computers: Desktop, Laptops, Palmtop, Tablet PC; Hardware & Software; Von Neumann model.

Module 2

Hardware: CPU, Memory, Input devices, output devices. Memory units: RAM, ROM-different types: Flash memory; Auxiliary storage: Magnetic devices, Optical Devices; Floppy, Hard disk, Memory stick, CD, DVD, CD-Writer; Input devices - keyboard, mouse, scanner, speech input devices, digital camera, Touch screen, Joystick, Optical readers, bar code reader; Output devices: Display device, size and resolution; CRT, LCD; Printers: Dot-matrix, Inkjet, Laser; Plotters, Sound cards & speaker.

Module 3

Software: System software, Application software; concepts of files and folders, Introduction to Operating systems, Different types of operating systems: single user, multitasking, time-sharing multi-user; Booting, POST; Basic features of two GUI operating systems: Windows & Linux (Basic desk top management); Programming Languages, Compiler, Interpreter, Databases; Application softwares: Generic Features of Word processors, Spread sheets and Presentation softwares; Generic Introduction to Latex for scientific typesetting; Utilities and their use; Computer Viruses & Protection, Free software, open source.

Module 4

Computer Networks: Connecting computers, Requirements for a network: Server, Workstation, switch, router, network operating systems; Internet: brief history, World Wide Web, Websites, URL, browsers, search engines, search tips; Internet connections: ISP, Dial-up, cable modem, WLL, DSL, leased line; email, email software features (send receive, filter, attach, forward, copy, blind copy); characteristics of web-based systems, Web pages, introduction to HTML.

References

1. E. Balaguruswamy, *Fundamentals of Computers*, McGraw hill, 2014
2. Dennis P Curtain, *Information Technology: The Breaking wave*, McGrawhill, 2014

VDAMGC102-Calculus & Real Analysis

CREDITS : 4
TOTAL LECTURE HOURS : 4 HOURS/WEEK

Module 1

Sets and sequences: Bounded and unbounded sets, supremum and infimum, neighbourhood of a point, limit point of a set, derived set, Bolzano-Weierstrass theorem (without proof), open and closed sets (definitions only). Sequences-Convergence and divergence of sequences, Bolzano-Weierstrass theorem, limit inferior and limit superior (Definitions and examples only), Cauchy's general principle of convergence, Cauchy sequences. Limits of some special sequences and algebra of sequences, Sandwich theorem. Cauchy's first and second theorems on limits, Monotonic sequences, Monotone convergence theorem.

Module 2

Infinite Series: Definition, positive term series, tests for convergence -comparison test, Cauchy's root test, D'Alembert's ratio test, Raabe's test, logarithmic test, alternating series, Leibnitz test for the convergence of alternating series, absolute convergence and conditional convergence.

Module 3

Functions of a Single Variable-1: Limits of a function, continuous functions, continuity at a point, continuity in an interval, discontinuous functions, types of discontinuity, functions continuous on closed intervals, uniform continuity.

Module 4

Functions of a Single Variable-2: Derivatives, derivability at a point, derivability in an interval, Darboux's theorem(without proof), intermediate value theorem for derivatives, Rolle's Theorem, Lagrange's Mean Value Theorem, Cauchy's Mean value theorem, Uniform convergence of sequences and series of functions, tests for uniform convergence of sequence and series of functions. Riemann Integration.

References

1. Malik, S.C. and Arora, S. (2014*). Mathematical Analysis*, Fourth Edition, New Age International limited, New Delhi.

VDAMSC103-Descriptive Statistics-I

CREDITS : 4
TOTAL LECTURE HOURS : 4 HOURS/WEEK

Module 1

Introduction to Statistics: Introduction to Statistics, concepts of a statistical population and sample, Data types- qualitative and quantitative, discrete and continuous, primary and secondary. Different types of scale- nominal and ordinal, ratio and interval. Collection of data- census and sampling, Sampling techniques- SRS, systematic, stratified and cluster(description only), schedule and questionnaire. Data collection: direct, using third parties, sending questionnaire, by mail/telephone, Classification and tabulation - One-way and two-way classified data, Preparation of frequency distribution, relative frequency and cumulative frequency distributions. Stem-and-leaf chart, Histogram, Frequency polygon, Frequency curve and Ogives.

Module 2

Descriptive Measures: Averages- Arithmetic Mean, Median, Mode, Geometric Mean, Harmonic Mean and Weighted averages. Quantiles- quartiles, deciles, percentiles. Absolute and relative measures dispersion - Range, Quartile Deviation, Mean Deviation and Standard Deviation, Co-efficient of variation, Box plot, Raw moments, central moments and their inter relation, skewness- Pearson's, Bowley's and moment measures of skewness, Kurtosis- percentile and moment measure of kurtosis.

Module 3

Probability & Random Variables: Random experiments-Algebra of events- Mutually exclusive, Equally likely and Independent events. Classical, Frequency and Axiomatic approaches to probability. Monotone property, Addition theorem (up to 3 events), Boole's inequality (finite case), and other simple properties. Conditional probability. Multiplication theorem (up to 3 events). Independence of events. Total probability law. Bayes' theorem. Concept of random variables- discrete and continuous random variables. Probability mass and density functions, and distribution functions. Evaluation of conditional and unconditional probabilities. Change of variables- methods of jacobian and distribution function (one variable case). Concept of a two-component random vector, Bivariate probability mass and density functions. Marginal and conditional distributions. Independence of bivariate random variables. Bivariate data- types of correlation, scatter diagram, Karl Pearson's product- moment and Spearman's rank correlation coefficients.

Module 4

Mathematical Expectation: Expectation of random variables and their functions. Definition of - Raw moments, central moments and their inter-relation, covariance, Pearson's correlation

coefficient in terms of expectation. MGF and simple properties. Moments from mgf. conditional mean and variance.

References

1. S P Gupta; Statistical Methods; Sultan Chand and Sons New Delhi
2. S C Gupta and V K Kapoor; Fundamentals of Mathematical Statistics; Sultan Chand and Sons New Delhi
3. M R Spiegel Theory and Problems of Statistics Schaum's Outline Series.

VDAMSC104-Introduction to Python Programming

CREDITS : 4
TOTAL LECTURE HOURS : 4 HOURS/WEEK

Module 1

Introduction to programming: Designing a program: development cycle, pseudo code, flowcharts and algorithm development; variables, numerical data types and literals, strings, assignment and reassignment, input/output, formatted output, reading numbers and strings

from keyboard; performing calculations: floating point and integer division, converting math

formulas to programming statements, standard mathematical functions, mixed-type expressions and data type conversions.

Module 2

Program Decision and Control Structures: Boolean expressions, relational expressions, logical operators, Boolean variables; if, if-else, if-elif-else, inline-if statements, nested structures, and flowcharts; use of temporary variables, application: arranging a few numbers in increasing or non-decreasing, decreasing or non-increasing orders, etc.

Module 3

Repeated calculations and Looping: condition-controlled and count-controlled loops, whileloop (condition-controlled), infinite loops; for-loop (count-controlled), applications: calculating summation of series, Taylor expansion of mathematical functions, etc; nested loops.

Module 4

Arrays, Lists and Tuples: lists, index, iterating over a list with for-loop, operations with lists,

built-in functions, finding index, sorting, etc., processing lists; Arrays: vectors and tuples, vector arithmetic, arrays, Numerical Python arrays – Numpy, curve plotting: matplotlib, SciTools, making animations and videos; Higher-dimensional arrays: two- and three-dimensional arrays, matrix objects and matrix operations: inverse, determinant, solving linear systems using standard libraries.

References

1. Tony Gaddis, Starting Out with Python, 3E, Pearson, 2015.Book contains flowcharting and pedagogical program development in an introductory Python book. Ch. 1 to 5, Ch 7.

2. Hans Petter Langtangen, A Primer on Scientific Programming with Python, 5E, Springer, 2016. Ch. 1 to 3, Ch. 4 (carefully selected material appropriate for first year students)

VDAMSC105- Softwares for Statistics

CREDITS : 3
TOTAL LECTURE HOURS : 3 HOURS/WEEK

Module 1

Spreadsheet Package: Introduction Excel user interface, working with cell and cell addresses, selecting a range, moving, cutting, copying, pasting, inserting and deleting cells, freezing cells, adding deleting copying worksheet within a workbook, renaming a worksheet. Cell formatting options, formatting fonts, aligning, wrapping and rotating text, using borders boxes and colours, centering a heading, changing row /columns height/width, formatting a worksheet automatically, insert comments, clear contents in a cell. Using print preview, margin and orientation, centering a worksheet, using headers and footers.

Module 2

Advanced features of spreadsheet package: All functions in Excel, using logical functions, statistical functions, mathematical. Elements of Excel charts, categories, creative chart, choosing chart type, edit chart access-titles, labels, data series and legend, adding a text box, rotate text in a chart, saving a chart.

Module 3

Presentation Package: MS Powerpoint- Advantages of presentation screen layout, creating presentation inserting slides, adding sounds and video formatting slides, slide layout views in presentation-slide transition, custom animatio,n managing slide shows-using pen setting slide intervals.

Module 4

Introduction to SPSS: Entering data into SPSS, Exploratory Analysis in SPSS,

References

1. Antony Thomas, Information Technology for Office, Pratibha Publications
2. Gini Courter and Annette Marquis, MS Office 2007; BPB Publications

Semester II

VGENCC201-Reading Skill
CREDITS : 4
TOTAL LECTURE HOURS : 4 HOURS/WEEK

Module 1

Recap of language skills: vocabulary, phrase, clause, sentences

Module 2

Fluency building: word match, reading aloud, recognition of attributes, parts of speech in listening and reading, listening –reading comprehension.

Module 3

Principles of communication: communication coding and decoding-signs and symbols-verbal and non-verbal symbols-language and communication; language vs. communication-media/channels for communication.

Module 4

Types of communication: functional, situational, verbal and non-verbal, interpersonal, group, interactive, public, mass line, dyadic-with illustrations.

References

1. Monippally, Matthukkutty M , Business communication strategies, Tata McGraw Hill Publications, New Delhi
2. Sasikumar V and P V Dhamija, Spoken English: A Self-learning Guide to Conversation Practice, Tata McGraw Hill Publications New Delhi
3. Hewings, Martin, Advance English Grammar: A Self Study Reference and Practice Book for South Asian Students Cambridge University

VDAMGC201- Introduction to DBMS
CREDITS : 4
TOTAL LECTURE HOURS : 4 HOURS/WEEK

Module 1

Introduction to Databases: Database Environment, The Relational Model and Languages: The Relational Model, Relational Algebra and Relational Calculus, QBE, Database Design:, ER diagrams and their transformation to relational design, Normalization, Security, Transaction Management: Transaction Support, Concurrency Control, Database Recovery.

Module 2

Languages: Data Definition Language (DDL), Data Manipulation Language (DML), Data Control Language (DCL) commands, Database objects like – Views, indexes, sequences, synonyms and data dictionary, SQL.

Module 3

Object Oriented Database Management Systems: Concepts, Composite objects, Integration with RDBMS applications, Issues in OODBMSs, Advantages and Disadvantages of OODBMSs

Module 4

Object-Oriented Database Design: Decision making processes, evaluation of DSS, Group decision support system. Distributed Databases

References

1. Database Administration: The Complete Guide to DBA Practices and Procedures by Craig S. Mullins
2. MySQL Database Usage & Administration by Vikram Vaswani

VDAMGC202- Linear Algebra-I
CREDITS : 4
TOTAL LECTURE HOURS : 4 HOURS/WEEK

Module 1

Matrices: Operations on Matrices-Addition, Multiplication, Transpose, Special types of matrices. systems of linear equations.

Module 2

Elementary operations: Gaussian elimination and row operations, Echelon form of a matrix, Elementary matrices and rank of a matrix, Existence of solution of AX=B.

Module 3

Matrix Algebra: Properties of determinants, Cofactor expansion, Inverse of a matrix.

Module 4

Eigen values and Eigenvectors: Properties and evaluation of eigen values and vectors, eigen values and vectors of special types of matrices.

References

1. Gilbert Strang, Linear Algebra and its Applications, Cengage.
2. H. Anton, C. Rorres, Elementary Linear Algebra, Wiley.
3. Derek Robinson, A Course in Linear Algebra with Applications, Allied publishers.

VDAMSC203-Introduction to R Programming
CREDITS : 4
TOTAL LECTURE HOURS : 4 HOURS/WEEK

Module 1

Basics of R: Installing the base R system and R-Studio. How to run R, R Sessions and Functions, Basic Math, Variables, Data Types, Vectors, Advanced Data Structures, Data Frames, Lists, Matrices, Arrays, Classes.

Module 2

Packages in R: Installing and loading packages, Familiarizing with popular packages and functions in R, Writing functions in R.

Module 3

R Programming Structures: Control Statements, Loops, - Looping Over Non vector Sets,- If-Else, Arithmetic and Boolean Operators and values, Default Values for Argument, Return Values, Deciding Whether to explicitly call return- Returning Complex Objects.

Module 4

Exploratory data analysis in R: Exploring categorical data, Exploring numerical data, Numerical summaries, case studies.

References

1. Crawley, Michael J. The R book. John Wiley & Sons, 2012.
2. Peng, Roger D. R programming for data science. Leanpub, 2016.

VDAMSC204-Statistical Inference
CREDITS : 4
TOTAL LECTURE HOURS : 4 HOURS/WEEK

Module 1

Point Estimation: Concepts of Estimation, Estimators and Estimates. Point and interval estimation. Properties of good estimators- unbiasedness, efficiency, consistency and sufficiency. factorization theorem (statement). (problems based on these topics)

Module 2

Methods of Estimation, Interval Estimation: Methods of moments, maximum likelihood. Invariance property of ML Estimators (without proof). minimum variance. Cramer-Rao inequality(without proof). $100(1-\alpha)\%$ confidence intervals for mean, variance, proportion, difference of means and proportions and variances (problems based on these topics).

Module 3

Testing of Hypotheses: Statistical hypotheses, null and alternate hypotheses, simple and composite hypotheses, type-I and type-II errors. Critical Region. Size and power of a test, p-value, Neyman-Pearson approach. Large sample tests - Z-tests for means, difference of means, proportion and difference of proportion, chi-square tests for independence, homogeneity and goodness of fit. Normal tests for mean, difference of means and proportion (when σ known), t-tests for mean and difference of means(when σ unknown), t-test for $r = 0$, paired t-test, test for proportion (binomial), chi-square test, F-test for ratio of variances. ANOVA

Module 4

Non Parametric Tests: Introduction to Non parametric tests, Non parametric equivalent of parametric tests.

References

1. Goon A. M., Gupta M. K., and Dasgupta B.(2005). Fundamentals of Statistics, Vol.I, 8th edition, World Press, Kolkatta.
2. Gupta S. C. and Kapoor V. K.(2002). Fundamentals of Mathematical Statistics, 11^{th} edition, Sultan Chand and Sons.

VDAMSC205-Statistical Distributions
CREDITS : 4
TOTAL LECTURE HOURS : 4 HOURS/WEEK

Module 1

Discrete Distributions: Degenerate, Uniform, Bernoulli, Binomial, Hyper geometric, Negative binomial, Geometric, Poisson - mean, variance, m.g.f, their properties-fitting of Binomial and Poisson, memory less property of Geometric distribution, multinomial distributions and its applications.

Module 2

Continuous Distributions: Uniform, Beta two types, Exponential, Gamma, Cauchy, Pareto, and Laplace - mean, variance, m.g.f, characteristic function, their properties - memory less property of exponential distribution.

Module 3

Normal and Lognormal Distributions: Properties, fitting of normal distribution, linear combination of normal variates, use of standard normal tables for various probability computation. Bivariate normal-marginal and conditional distributions.

Module 4

Sampling Distributions: Concept of sampling distributions, Statistic(s) and standard error(s). Mean and variance of sample mean when sampling is from a finite population. Sampling distribution of mean and variance from normal distribution. Chi-square, t, F distributions and statistics following these distributions. Relation among Normal, Chi-square, t and F distributions.(Problems based on these topics)

References

1. Hogg, R.V., McKean, J.W.and Craig, A.T.(2014). Introduction to Mathematical Statistics,(7th ed.), Pearson Education Publication.

2. Gupta,S.C.and Kapoor, V.K. (2014).Fundamentals of Mathematical Statistics, Sultan Chand & Sons, New Delhi.

Semester III

VGENCC301- Writing and Presentation Skills
CREDITS : 4
TOTAL LECTURE HOURS : 4 HOURS/WEEK

Module 1

Writing as a skill: its importance – mechanism of writing – words and sentences – paragraph as a unit of structuring a whole text – combining different sources – functional use of writing – personal, academic and business writing – creative use of writing.

Module 2

Writing process: planning a text – finding materials - drafting – revising – editing - finalizing the draft - computer as an aid – key board skills - word processing - desk top publishing.

Module 3

Writing models: essay - précis - expansion of ideas – dialogue - letter writing – personal letters formal letters - CV – surveys – questionnaire - e-mail – fax - job application - report writing.

Module 4

Presentation as a skill: elements of presentation strategies – audience – objectives – medium– key ideas -structuring the material - organizing content - audio-visual aids – hand outs – use of power point - clarity of presentation - non-verbal communication - seminar paper presentation and discussion.

References

1. *English for Effective Communication*. Oxford University Press, 2013.
2. Robert, Barraas. *Students Must Write*. London: Routledge, 2006.
3. Bailey, Stephen. *Academic Writing.*Routledge, 2006.

VDAMGC301-Enterprise Resource Planning
CREDITS : 4
TOTAL LECTURE HOURS : 4 HOURS/WEEK

Module 1

ERP: Evolution of ERP, MRP and MRP 2, difference between integrated and traditional information system, early and new ERP packages, ERP products and markets, benefits of ERP system implementation, critical success rate.

Module 2

Selection and Implementation: opportunity and problems in ERP selection and implementation, ERP implementation, identifying ERP benefits, emergence of reengineering, concepts of business process-identifying reengineering need, preparing for reengineering implementing change-change management-integrating with other systems

Module 3

Modules of ERP: business modules of ERP package, salient features of each module comparison of ERP package, business process modeling, gap analysis, emerging trends in business process, selection of ERP process for implementation.

Module 4

Technical Architecture of ERP system: communication and networking facilities, client service system, concepts of business objects, distributed object, computing architecture, support for data mining and warehousing, EDI-internet and related technologies.-net technologies. ERP and supply chain management-extending scope of ERP through SCM, the concept of value chain differentiation between ERP and SCM, issues in selection and implementation of SCM solutions-E-Business and ERP, security and privacy issues-recent development-future growth of ERP –role of ERP international business

References

1. Jyotindra Zaveri, Enterprise Resource Planning
2. Ptak, Carol A. and Eli Schragenheim, Enterprise Systems for Management, St. Luice Press, New York

VDAMGC302-Linear Algebra II
CREDITS : 4
TOTAL LECTURE HOURS : 4 HOURS/WEEK

Module 1

Vector Spaces: Vector spaces, Subspaces, Span and linear independence, Basis and dimension, Row and column space of a matrix, Change of Basis.

Module 2

Linear transformations: Linear transformations, Range space and rank, null space and nullity, Matrix representation, Isomorphism.

Module 3

Similarity: Diagonalization and Similar Matrices.

Module 4

Quadratic Forms: Quadratic Forms, Definiteness of QF.

References

1. K. Hoffman and R. Kunze, Linear Algebra, Prentice Hall.
2. Sheldon Axler, Linear Algebra Done Right, 2nd Edition, Springer.

VDAMSC303-Advanced Python Programming
CREDITS : 4
TOTAL LECTURE HOURS : 4 HOURS/WEEK

Module 1

Intermediate Python: Matlibplot, Dictionaries and Pandas, Logic, Control flow and filtering

Module 2

Importing data in Python: Importing from flat files such as .txts and .csvs, from files native to other software such as Excel spreadsheets, Stata, SAS and MATLAB files, from relational databases such as SQLite & PostgreSQL, from the web and from Application Programming Interfaces, also known as APIs

Module 3

Cleaning data in Python: Exploring data, tidying data for analysis, combining data for analysis, cleaning data for analysis, case studies. Manipulating dataframes with pandas- Extracting and transforming data, advanced indexing, rearranging and reshaping data, grouping data.

Module 4

Exploratory data analysis in Python: Graphical exploratory analysis, numerical exploratory analysis

References

1. VanderPlas, Jake. Python data science handbook: essential tools for working with data. "O'Reilly Media, Inc.", 2016.
2. Grus, Joel. Data science from scratch: first principles with python. O'Reilly Media, 2019.

VDAMSC304-Advanced R Programming
CREDITS : 4
TOTAL LECTURE HOURS : 4 HOURS/WEEK

Module 1

Importing data in R: Importing data from flat files with utils, readr& data.table, importing Excel data, Reproducible Excel work with XLConnect, Importing data from database files, Importing data from web, Importing data from statistical software packages.

Module 2

Basics of Data Manipulation in R: Cleaning data in R: Introduction and exploring raw data, tidying data, preparing data for analysis, case studies

Module 3

Data Manipulation with dplyr package: select, mutate, filter, arrange and summarise verbs, the pipe operator, joining data sets with dplyr: mutating joins, filtering joins and set operations, assembling data, advanced joining, case studies

Module 4

Data visualization with ggplot2: Introduction, The grammar of graphics philosophy, different layers in ggplot, data, aesthetics, geometries layers.

References

1. Crawley, Michael J. The R book. John Wiley & Sons, 2012.
2. Wickham, Hadley, and Garrett Grolemund. R for data science: import, tidy, transform, visualize, and model data. " O'Reilly Media, Inc.", 2016.
3. Peng, Roger D. R programming for data science. Leanpub, 2016.

VDAMSC305-Multivariate Analysis
CREDITS : 4
TOTAL LECTURE HOURS : 4 HOURS/WEEK

Module 1

Bivariate normal distribution: marginal and conditional distributions, Multinomial distribution. Multivariate normal - marginal and conditional distributions, properties and characterizations, estimation of mean and dispersion matrix. Independence of sample mean and sample dispersion matrix

Module 2

Multivariate testing: Likelihood ratio test, Hotelling's T2 (one and two samples), Mahalanobi's D2 statistic, Fisher-Behren problem, MANOVA (one way and two-way)

Module 3

Multivariate tools: Dimension reduction methods, principal components, canonical correlation, profile analysis, factor analysis.

Module 4

Classification problem, discriminant analysis, Bayes' procedures, Fisher's approach, more than two groups, selection of variables. testing independence of sets of variates, tests for equality of dispersion matrices, sphericity test. Cluster analysis, proximity data, hierarchical clustering, non-hierarchical clustering methods.

References

1. Anderson T. W. (1984) An Introduction to Multivariate Statistical Analysis (2^{nd} ed.) John Wiley.
2. Johnson R.A. and Wichern D.W. (1990) Applied Multivatiate Statistical Analysis. Pearson education.

Semester IV

VGENCC401- Soft Skill and Personality Development
CREDITS : 4
TOTAL LECTURE HOURS : 4 HOURS/WEEK

Module – 1

Personal Skills: Knowing oneself- confidence building- defining strengths- thinking creatively- personal values-time and stress management.

Module – 2

Social Skills: Appropriate and contextual use of language- non-verbal communication-interpersonal skills- problem solving.

Module – 3

Personality Development: Personal grooming and business etiquettes, corporate etiquette,social etiquette and telephone etiquette, role play and body language.

Module – 4

Presentation skills: Group discussion- mock Group Discussion using video recording – public speaking.

Module – 5

Professional skills: Organisational skills- team work- business and technical correspondence-job oriented skills-professional etiquettes.

References

1. Matila Treece: Successful communication: Allyun and Bacon Pubharkat.

Jon Lisa Interatid skills in Tourist Travel Industry Longman Group Ltd.

2. Robert T. Reilly – Effective communication in tourist travel Industry Dilnas Publication.
3. Boves. Thill Business Communication Today Mcycans Hills Publication.
4. Dark Studying International Communication Sage Publication.
5. Murphy Hidderandt Thomas Effective Business Communication Mc Graw Hill.

VDAMGC401- Business Ethics
CREDITS : 4
TOTAL LECTURE HOURS : 4 HOURS/WEEK

Module 1

Introduction-Concept, relevance and importance, Ethical principles and relevance in business, Normative and Justice & Fairness .

Module 2

Ethics and the organization. Organizational ethics, basic elements of an ethical organization, designing of code of ethics of an organization, dimensions of organizational ethics, benefits of managing ethics in the organization, current ethical related issues in organizations.

Module 3

Environmental Ethics Sustainable Development, Industrial Pollution & Environmental Issues.

Module 4

Corporate Governance Introduction to corporate governance, Importance, Issues and Obligations. Consumer Protection Consumer & Consumer protection and Legal Protection to consumers.

References

1. Business Ethics Concepts & Cases ,Velasquez, TMH Publication.

VDAMGC402-Fuzzy Mathematics
CREDITS : 4
TOTAL LECTURE HOURS : 4 HOURS/WEEK

Module 1

Fuzzy Sets : Basics, Classical sets vs Fuzzy Sets – Need for fuzzy sets – Definition and Mathematical representations – Level Sets – Fuzzy functions - Zadeh's Extension Principle

Module 2

Operations on Fuzzy Sets: Operations on [0,1] – Fuzzy negation, triangular norms, t-conorms, fuzzy implications, Aggregation Operations, Fuzzy Functional Equations

Module 3

Fuzzy Relations: Fuzzy Binary and n-ary relations – composition of fuzzy relations – Fuzzy Equivalence Relations – Fuzzy Compatibility Relations – Fuzzy Relational Equations

Module 4

Possibility Theory and Approximate Reasoning: Fuzzy Measures – Evidence Theory – Necessity and Belief Measures – Probability Measures vs Possibility Measures. Fuzzy Decision Making - Fuzzy Relational Inference – Compositional Rule of Inference – Efficiency of Inference - Hierarchical

References

1. George J Klir and Bo Yuan, Fuzzy Sets and Fuzzy Logic : Theory and Applications, Prentice Hall NJ,1995.
2. H.J. Zimmermann, Fuzzy Set Theory and its Applications, Allied Publishers, New Delhi, 1991.
3. Kevin M Passino and Stephen Yurkovich, Fuzzy Control, Addison Wesley Longman, 1998.

VDAMSC403-Sampling &Design of Experiments
CREDITS : 4
TOTAL LECTURE HOURS : 4 HOURS/WEEK

Module 1

Sampling 1: Census and sampling methods, probability sampling and non-probability sampling, principal steps in sample surveys, sampling errors and non-sampling errors, bias, variance and mean square error of an estimator, simple random sampling with and without replacement, estimation of the population mean, total and proportions, properties of the estimators, variance and standard error of the estimators, confidence intervals, determination of the sample size.

Module 2

Sampling 2: Stratified random sampling, estimation of the population mean, total and proportion, properties of estimators, various methods of allocation of a sample, comparison of the precisions of estimators under proportional allocation, optimum allocation and srs. Systematic sampling – Linear and Circular, estimation of the mean and its variance. comparison of systematic sampling, srs and stratified random sampling for a population with a linear trend.

Module 3

Linear estimation: standard Gauss Markoff set up, estimability of parameters, method of least squares, best linear unbiased Estimators, Gauss – Mark off Theorem, tests of linear hypotheses.

Planning of experiments, Basic principles of experimental design, uniformity trails, analysis of variance, one-way, two-way and three-way classification models, completely randomized design (CRD), randomized block design (RBD) latin square design (LSD) and Graeco-latin square designs, Analysis of covariance (ANCOVA), ANCOVA with one concomitant variable in CRD and RBD.

Module 4

Incomplete block design: balanced incomplete block design (BIBD); incidence Matrix, parametric relation; intrablock analysis of BIBD, basic ideas of partially balanced incomplete block design (PBIBD). Factorial experiments, 2n and 3n factorial experiments, analysis of 22, 23 and 32 factorial experiments, Yates procedure, confounding in factorial experiments, basic ideas of response surface designs.

References

1. Cochran W. G. (1999) Sampling Techniques, 3rd edition, John Wiley and Sons.
2. Mukhopadyay P. (2009) Theory and Methods of Survey Sampling, 2nd edition, PHL, New Delhi.

3. Aloke Dey (1986) Theory of Block Designs, Wiley Eastern, New Delhi.
4. Das M.N. and Giri N.C. (1994) Design and analysis of experiments, Wiley Eastern Ltd.

VDAMSC404-Time Series Analysis
CREDITS : 4
TOTAL LECTURE HOURS : 4 HOURS/WEEK

Module 1

Basics of Time series: components of time series, additive and multiplicative models, determination of trend, analysis of seasonal fluctuations, test for trend and seasonality, exponential and moving average smoothing, holt-winter smoothing, forecasting based on smoothing.

Module 2

Time series as a discrete parameter stochastic process: auto covariance and auto correlation functions and their properties, stationary processes, test for stationarity, unit root test, stationary processes in the frequency domain, spectral analysis of time series.

Module 3

Detailed study of the stationary processes: moving average (MA), autoregressive (AR), autoregressive moving average (ARMA) and autoregressive integrated moving average (ARIMA) models.

Module 4

Estimation of ARMA models: maximum likelihood method (the likelihood function for a Gaussian AR(1) and a Gaussian MA(1)) and Least squares, Yule-Walker estimation for AR Processes, choice of AR and MA periods, forecasting, residual analysis and diagnostic checking.

References

1. Chatfield C. (2004) The Analysis of Time Series - An Introduction (Sixth edition), Chapman and Hall.
2. Abraham B. and Ledolter J.C. (1983) Statistical Methods for Forecasting, Wiley.

VDAMSC405-Machine Learning I
CREDITS : 4
TOTAL LECTURE HOURS : 4 HOURS/WEEK

Module 1

Techniques of Machine Learning: Supervised learning, Unsupervised learning, Semi supervised learning, Reinforcement learning, Machine Learning Algorithm, Application of machine learning. Capacity, Overfitting and underfitting, Hyper parameters, Estimator, Bias and Variance, Maximum likelihood estimation, Stochastic Gradient descent

Module 2

Resampling methods: Cross validation and the bootstrap, Linear model selection and Regularization: Subset selection, Shrinkage methods, Dimension reduction methods, Considerations in high dimensions.

Module 3

Feature Engineering: Feature Improvement: Dealing with missing data, Standardization & normalization; Feature Selection: Statistics based feature selection, model based feature selection; Feature transformation: Principal Component Analysis, linear discriminant analysis; Feature Learning.

Module 4

Introduction, Simple Linear regression, Multiple linear regression, Extensions of the linear model, Classification: overview, Logistic regression, Linear discriminant analysis, comparison of classification methods.

References

2. G. James, R. Tibshirani, An Introduction to Statistical Learning: with applications in R, Springer.
3. T. Hastie, R. Tibshirani, Elements of Statistical Learning: Data mining, Inference and Predicton, Springer.
4. Kevin Murphy, Machine Learning: A Probabilistic Perspective, MIT Press.

Semester V

VGENCC501-Environmental studies
CREDITS : 4
TOTAL LECTURE HOURS : 4 HOURS/WEEK

Module 1

Multidisciplinary nature of environmental studies Definition, scope and importance-Need for public awareness. Natural Resources : Renewable and non-renewable resources : Natural resources and associated problems. Forest resources : Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people. Water resources : Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems. Mineral resources : Use and exploitation, environmental effects of extracting and using mineral resources, case studies. Food resources : World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. Energy resources : Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. Case studies. Land resources : Land as a resource, land degradation, man induced landslides, soil erosion and desertification. Role of an individual in conservation of natural resources. Equitable use of resources for sustainable lifestyles.

Module 2

Ecosystems Concept of an ecosystem-Structure and function of an ecosystem-Producers, consumers and decomposers-Energy flow in the ecosystem-Ecological succession-Food chains, food webs and ecological pyramids-Introduction, types, characteristic features, structure and function of the following ecosystem : Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Biodiversity and its conservation Introduction – Definition : genetic, species and ecosystem diversity, Biogeographically classification of India, Value of biodiversity : consumptive use, productive use, social, ethical, aesthetic and option values, Biodiversity at global, National and local levels, India as a mega-diversity nation Hot-spots of biodiversity, Threats to biodiversity : habitat loss, poaching of wildlife, man-wildlife conflicts., Endangered and endemic species of India, Conservation of biodiversity : In-situ and Ex-situ conservation of biodiversity.

Module 3

Environmental Pollution Definition ,Cause, effects and control measures of :- Air pollution- Water pollution-Soil pollution Marine pollution-Noise pollution-Thermal pollution-Nuclear hazards Solid waste Management : Causes, effects and control measures of urban and industrial wastes. Role of an individual in prevention of pollution, Pollution case studies, Disaster management : floods, earthquake, cyclone and landslides. Human Population and the Environment Population growth, variation among

nations-Population explosion – Family Welfare Programme- Environment and human health-Human Rights-Value Education- HIV/AIDS-Women and Child Welfare- Role of Information Technology in Environment and human health-Case Studies.

Module 4

Social Issues and the Environment From Unsustainable to Sustainable development-Urban problems related to energy-Water conservation, rain water harvesting, watershed management- Resettlement and rehabilitation of people; its problems and concerns-Case Studies Environmental ethics : Issues and possible solutions. Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust-Case Studies. Wasteland reclamation- Consumerism and waste products-Environment Protection Act-Air (Prevention and Control of Pollution) Act-Water (Prevention and control of Pollution) Act-Wildlife Protection Act-Forest Conservation Act-Issues involved in enforcement of environmental legislation-Public awareness

TEXT BOOK

Textbook for Environmental Studies For Undergraduate Courses of all Branches of Higher Education.

FURTHER ACTIVITIES

Field work

Visit to a local area to document environmental assets river/forest/grassland/hill/mountain

Visit to a local polluted site-Urban/Rural/Industrial/Agricultural

Study of common plants, insects, birds.

Study of simple ecosystems-pond, river, hill slopes, etc. (Field work Equal to 5 lecture hours)

VDAMGC501- Business Informatics
CREDITS : 4
TOTAL LECTURE HOURS : 4 HOURS/WEEK

Module 1

History of e-commerce, definition, classification- B2B, B2C, C2C, G2C, B2G sites, ecommerce in education, financial, auction, news, entertainment sectors, Doing e-Commerce.

Module 2

Electronic payment systems – relevance of currencies, credit cards, debit cards, smart cards, e-credit accounts, e-money, security concerns in e commerce, authenticity, privacy, integrity, non-repudiation, encryption, secret key cryptography, public key cryptography, digital signatures, firewalls

Module 3

Mass marketing, segmentation, one-to-one marketing, personalization and behavioural marketing, web advertising, online advertising methods, advertising strategies and promotions, special advertising and implementation topics.

Module 4

Mobile Commerce: attributes and benefits, Mobile Devices, Computing software, Wireless Telecommunication devices, Mobile finance applications, Web 2.0 Revolution, social media and industry disruptors, Virtual communities, Online social networking: Basics and examples, Web 3.0 and Web 4.0, Civil law, intellectual property law, common law and EC legal issues

References

1. Erfan Turban et.al., *Electronic Commerce–A Managerial Perspective*, Pearson Education
2. R Kalokota, Andrew V. Winston, *Electronic Commerce – a Manger's guide*, Pearson

VDAMGC502- Operations Research-I & Numerical Methods
CREDITS : 4
TOTAL LECTURE HOURS : 4 HOURS/WEEK

Module 1

Linear programming: introduction to linear programming problems (LPP), graphical solution, feasible, basic feasible and optimal basic feasible solutions to an LPP, theoretical development of simplex method.

Module 2

big-M method, two-phase simplex method, dual of linear programming, theorems of duality, dual-simplex method.

Module 3

Solution to algebraic and transcendental equations:- Bisection Method, Iteration method, Regula -falsi method, Newton-Raphson method. Solution to Simultaneous linear equations:- Gauss elimination method, Gauss-Jordan methods, Jacobi's method, Gauss-Seidel method, solution to non-linear equations – Newton Raphson method. Interpolation - Newtons forward interpolation formula, Lagrange's interpolation formula, Numerical integration- General Quadrature formula, Newton-Cotes formula, Trapeizoidal, Simpson's (1/3), Simpson's (3/8) and Weddle's formula

Module 4

Monte Carlo methods, Random Number Generation- Basic principles of Random number generation, inversion method, accept-reject method, Random number generation from Uniform, Exponential, Cauchy, Normal, Beta, Gamma densities, Random number generation from Binomial, Poisson and Geometric.

References

1. Sastry S.S. (1998) Introductory methods of numerical analysis. Third edition, Printice Hall, New Delhi.
2. Mohanan J.F (2001) Numerical methods of statistics, Cambridge University Press.
3. Srimanta Pal (2009) Numerical Methods- Principles, Analysis and Algorithms. Oxford University Press.
4. J K Sharma Operations research – Theory and Applications Macmillan.
5. Frederick S Hiller and Gerala Jlieberman, Introduction to Operations Research Tata Mcgraw Hill.
6. Kanti Swarup, Gupta, Manmohan (2004) 10^{th} edition, Operations Research – Principles and Practice.

VDAMSC503- Introduction to Big data
CREDITS : 4
TOTAL LECTURE HOURS : 4 HOURS/WEEK

Module 1

Introduction to Big Data: Types of Digital Data - Characteristics of Data – Evolution of Big

Data - Definition of Big Data - Challenges with Big Data-3Vs of Big Data - Non Definitional traits of Big Data - Business Intelligence vs. Big Data - Data warehouse and Hadoop environment - Coexistence.

Module 2

Big Data Analytics: Classification of analytics - Data Science - Terminologies in Big Data -

CAP Theorem - BASE Concept. NoSQL: Types of Databases – Advantages – NewSQL - SQL vs. NOSQL vs NewSQL.

Module 3

Introduction to Hadoop: Features – Advantages – Versions - Overview of Hadoop Eco systems - Hadoop distributions - Hadoop vs. SQL – RDBMS vs. Hadoop – Hadoop Components – Architecture – HDFS - Map Reduce: Mapper – Reducer – Combiner – Partitioner – Searching – Sorting - Compression. Hadoop 2 (YARN): Architecture - Interacting with Hadoop Eco systems.

Module 4

Understanding MapReduce: Key/value pairs, The hadoop java API for MapReduce, The mapper class, The reducer class, The driver class,Writing simple MapReduce programs, Hadoop-provided mapper and reducer implementations, Hadoop-specific data types, The writable and writablecomparable interfaces, Wrapper classes, Input/output – Input format and Recordreader,Outputformat and recordwriter

References

5. Hurwitz, Alan Nugent, Fern Halper and Marcia Kaufman, *Big Data for Dummies* , John Wiley & Sons, 2013
6. Silberschatz A, Korth H F and Sudharshan S, “Database System Concepts”, Sixth Edition, Tata McGraw-Hill Publishing Company Limited, 2010.
7. Seema Acharya, Subhashini Chellappan, “Big Data and Analytics”, Wiley Publication, 2015.
8. Tom White, “Hadoop: The Definitive Guide”, O’Reilly Publications, 2011.

VDAMSC504-Machine Learning II
CREDITS : 4
TOTAL LECTURE HOURS : 4 HOURS/WEEK

Module 1

Polynomial regression, step functions, basis functions, regression splines, smoothing splines,

local regression, generalised additive models for regression and classification problems.

Module 2

Introduction to Decision Trees. Regression trees, Classification trees, comparison of trees and linear models, Bagging, Random Forests, Boosting.

Module 3

Support Vector Machines: Hyperplane, Maximum Margin Classifier, Support Vector Classifiers, Support Vector Machines, One vs One Classification and One vs All Classification, Relationship to Logistic Regression. Unsupervised Learning: Principal Component Analysis and its applications, K-Means Clustering and Hierarchical Clustering.

Module 4

Neural Networks: Introduction, Projection Pursuit Regression, Neural Networks, Fitting Neural Networks, Some issues in Training Neural Networks-Starting Values, Overfitting, Scaling of the Inputs, Number of Hidden Units and Layers, Multiple Minima. Optimization, Challenges in neural network optimization, Parameter initialization strategy, Adaptive learning rates, Optimization algorithms

References

1. G. James, R. Tibshirani, An Introduction to Statistical Learning: with applications in R, Springer.
2. T. Hastie, R. Tibshirani, Elements of Statistical Learning: Data mining, Inference and Predicton, Springer.
3. Kevin Murphy, Machine Learning: A Probabilistic Perspective, MIT Press.
4. Ian Goodfellow, Yoshua Bengio and Aaron Courville, Deep Learning, MIT Press. (Chapters 5-10)

Semester VI

VGENCC601- Entrepreneurship Development Program
CREDITS : 4
TOTAL LECTURE HOURS : 4 HOURS/WEEK

Module – 1

To make the students understand about entrepreneurs and different classifications. Entrepreneur and entrepreneurship - Definition; traits and features; classification; Entrepreneurs; Women entrepreneurs; Role of entrepreneur in Entrepreneurs in India.

Module – 2

Create an awareness about EDP. Entrepreneurial development programme concept; Need for training; phases of EDP; curriculum & contents of Training Programme; Support systems, Target Groups; Institutions conducting EDPs in India and Kerala.

Module – 3

General awareness about identification of project financing new enterprises. Promotion of a venture; opportunity Analysis Project identification and selection; External environmental analysis economic, social, technological an competitive factors; Legal requirements for establishment of a new unit; loans; Overrun finance; Bridge finance; Venture capital; Providing finance in Approaching financing institutions for loans.

Module – 4

To identify different Discuss opportunities in small business. Small business Enterprise - Identifying the Business opportunity in various sectors - formalities for setting up of a small business enterprise - Institutions supporting small business enterprise - EDII (Entrepreneurship Development Institute of India), SLDO (Small Industries Development Organization NSIC (National small Industries Corporation Ltd. (CNSIC) NIESBUD (National Institute for Entrepreneurship and small Business Development) Sickness in small business enterprise causes and remedies.

Module – 5

To understand about a project report relating to a small business. Project formulation - Meaning of a project report significance contents formulation planning commissions guidelines for formulating a project report - specimen of a project report, problems of entrepreneurs case studies of entrepreneurs.

References

1. Cliffton, Davis S. and Fylie, David E., Project Feasibility Analysis, John Wiley, New York, 1977.
2. Desai A. N., Entrepreneur and Environment, Ashish, New Delhi, 1990.
3. Drucker, Peter, Innovation and Entrepreileurship, Heinemann, London, 1985

4. Jain Rajiv, Planning a Small Scale Industry: A guide to Entrepreneurs, S.S. Books, Delhi, 1984
5. Kumar S. A., Entrepreneurship in Small Industry, Discovery, New Delhi, 1990

VDAMGC601-Principles of Management
CREDITS : 4
TOTAL LECTURE HOURS : 4 HOURS/WEEK

Module 1

Introduction to Entrepreneur and Entrepreneurship-definition, traits and features, classification, role of Entrepreneurs

Module 2

Create an awareness about EDP, EDP concept, need for training, phases of EDP, curriculum and contents for EDP training programme, support system target groups, target groups, institutions conducting EDP in India

Module 3

General awareness of edification of project financing new enterprises, promotion of a venture, opportunity analysis project identification and selection, external environmental analysis, venture capital

Module 4

To identify different opportunities in small business, small business enterprise, identifying business opportunities in various sectors, formalities for setting up of small business enterprise-institutions supporting small business enterprises, sickness in small business enterprise causes and remedies. Project formulation-guidelines for formulating a project report-specimen of project report-problems of Entrepreneurs- case studies of entrepreneurs

References

1. Desai A.N, Entrepreneur and Environment
2. Jain Rajiv, Planning A Small Scale Industry: A Guide To Entrepreneurs, S.S Books
3. Mc Cleffand , D.C. and winter, W.G., Motivating Economic Achievement, Free Press, New York

VDAMGC602-Operations Research-II
CREDITS : 4
TOTAL LECTURE HOURS : 4 HOURS/WEEK

Module 1

Assignment Problem: Introduction to Assignment Problem, Mathematical Formulation, Solutions

Module 2

Transportation Problem:

Module 3

Sequencing Problem, Travelling Salesman Problem.

Module 4

Network analysis, GANTT, CPM, PERT.

References

1. J K Sharma Operations research – Theory and Applications Macmillan.
2. Frederick S Hiller and Gerala Jlieberman, Introduction to Operations Research Tata Mcgraw Hill.
3. Kanti Swarup, Gupta, Manmohan (2004) 10^{th} edition, Operations Research – Principles and Practice.

VDAMSC603-Advanced topics in Deep Learning
CREDITS : 5
TOTAL LECTURE HOURS : 5 HOURS/WEEK

Module 1

Introduction to Tensorflow, Installing and learning its basics, Recap of Neural networks, Convolution neural networks(CNN) and Recurrent Neural Networks (RNN)

Module 2

Autoencoder and Decoders, Introduction to Generative Adversarial networks (GANs)

Module 3

Introduction to Speech Processing, important neural network architectures used in them

Module 4

Introduction to Natural Language processing (NLP), Important neural network architectures used in them

References

1. Ian Goodfellow, Yoshua Bengio and Aaron Courville, Deep Learning, MIT Press.

VDAMSC604- Data Mining Concepts
CREDITS : 4
TOTAL LECTURE HOURS : 4 HOURS/WEEK

Module 1

Data mining: Meaning, Definition, Goals, Scope, Related technologies, Stages involved in data mining, Data mining techniques , Major issues in data mining, Applications.

Module 2

Data objects and attribute types attribute generalization and relevance, Class comparison, Statistical measures, Data visualization, Measures of similarity and dissimilarity; Data preprocessing: Overview, Data cleaning, Data integration, Data reduction, Data transformation, Discretization, Generating concept hierarchies.

Module 3

Mining frequent patterns, associations and correlations: Basic concepts and methods, Frequent itemset mining methods -Apriori algorithm, Pattern growth approach, Framing association rules, Pattern evaluation methods, Pattern mining concepts, Mining in multi level and multidimensional space, Constraint based frequent pattern mining.

Module 4

Text mining ,Web mining, Spatial mining, Illustration of mining real data , Preprocessing data from a real domain , Applying various data mining techniques to create a comprehensive and accurate model of the data clustering.

References

1. Pang-Ning Tan,Michael Steinbach and Vipin Kumar , *Introduction to Data Mining*, Pearson Education Inc , 2003

2. Alex Berson and Stephen J. Smith, *Data Warehousing, Data Mining & OLAP, Computing* Mcgraw-Hill, Tata McGraw-Hill Education, 2004

3. K.P. Soman, Shyam Diwakar and V. Ajay, *Insight into Data mining Theory and Practice*, Prentice Hall of India, 1st Edition