PROGRAMME GUIDE

FOR

Master of Science (M.Sc.)

(Artificial Intelligence and Machine Learning)

(MSCAIML)

(2 – Years Programme)

(Programme Code: MSCAIML)

July, 2026

SCHOOL OF COMPUTER AND INFORMATION SCIENCES (SOCIS)

INDIRA GANDHI NATIONAL OPEN UNIVERSITY

MAIDAN GARHI, NEW DELHI-110068

ePrograme Guide:

July, 2026 (version 1). This is a Programme Guide for MSCAIML Programme offered by IGNOU from July, 2026 admission cycle.

Further information on the Indira Gandhi National Open University courses can be obtained from the University's office at Maidan Garhi, New Delhi-110 068 or from its Regional Centres spread across the length and breadth of the country.

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Message from the MSCAIML Programme Coordinator(s)

Dear Learners,

It gives us immense pleasure to welcome you to the inaugural batch of IGNOU's **Master of Science in Artificial Intelligence and Machine Learning (MSCAIML)** programme. This innovative two-year (four-semester) programme has been introduced to address the growing demand for skilled professionals in the rapidly evolving domains of Artificial Intelligence and Machine Learning. It marks a significant milestone for Indira Gandhi National Open University in delivering cutting-edge, interdisciplinary education that effectively combines theoretical foundations with practical applications.

As members of the first cohort, you hold a unique and distinguished position in shaping the future of this programme and contributing to its continued success.

The curriculum has been carefully designed to provide a comprehensive understanding of the principles, tools, and applications of Artificial Intelligence and Machine Learning. It encompasses a wide range of subjects, including mathematical foundations, artificial intelligence, data structures and algorithms, machine learning, deep learning, natural language processing, cloud computing, and related emerging technologies. Through a balanced integration of theory courses, practical laboratory sessions, and a capstone project, the programme aims to equip learners with the knowledge, analytical thinking, and problem-solving skills required to excel in today's data-driven world.

Hands-on learning forms a core component of this programme. To ensure the development of practical proficiency, each semester includes dedicated practical components designed to reinforce the theoretical concepts covered in the courses. Learners are required to maintain a minimum of 75% attendance in practical counselling sessions to become eligible for the Term-End Practical Examinations. In addition, timely submission of assignments is mandatory for appearing in both theory and practical examinations.

To provide a meaningful and well-supported learning experience, IGNOU offers a robust academic support ecosystem through its network of Regional Centres (RCs) and Learner Support Centres (LSCs) (formerly known as Study Centres). These centres serve as your primary points of contact for academic guidance and administrative assistance throughout the programme.

Learners will also have access to self-learning materials through the eGyankosh platform, which hosts a rich repository of digital learning resources. In addition, regular theory and practical counselling sessions are organized to strengthen conceptual understanding and provide hands-on exposure to modern tools and techniques in Artificial Intelligence, data analysis, and machine learning.

We encourage you to remain actively engaged with your RC, LSC, faculty members, and peer group, and to participate enthusiastically in discussions, collaborative projects, and online learning activities. Such interactions will not only deepen your understanding of the subject matter but also help you build a strong network of like-minded learners and professionals.

This Programme Guide has been prepared as a comprehensive reference document to support you throughout your academic journey. It contains detailed information regarding the instructional system, programme structure, course syllabus, evaluation scheme, assignment submission process, counselling sessions, and examination guidelines. The Guide also includes important links to essential forms, formats, and online resources that will assist you during your studies.

Assignments constitute an important component of the continuous evaluation process. Learners are required to download their semester-wise assignments from the official IGNOU website and submit them to their respective Learner Support Centres within the prescribed deadlines. Timely submission of assignments is mandatory for eligibility to appear in the Term-End Examinations (TEE).

Please note that the fee structure and certain administrative provisions mentioned in admission or re-registration forms may be revised periodically by the University. Learners are therefore advised to verify the latest information through the official IGNOU website or by contacting their respective Regional Centre or Learner Support Centre before making any payments or submissions.

We are delighted to have you join this landmark programme and look forward to supporting you at every stage of your academic journey.

With best wishes for your success,

Programme Coordinator(s):
Prof. Divakar Yadav and Prof. Sandeep Singh Rawat
M.Sc. (Artificial Intelligence and Machine Learning)
Email: mscaiml@ignou.ac.in

1. BASIC INFORMATION

1.0 Programme Objectives

The M.Sc. (Artificial Intelligence and Machine Learning) programme is designed to prepare graduate students for successful careers in the software industry and academia. Following are the objectives:

- To provide a strong foundation in programming and ML algorithms for solving diverse problems.
- To equip with the skills to collect, manage, analyze and interpret large and complex datasets.
- To apply machine learning and deep learning techniques to solve real-world problems in various domains such as business, healthcare, social sciences, and engineering.
- To prepare for careers as Machine Learning Engineer, Data Scientist, AI Research Scientist.

1.1 Duration of the Programme

(Minimum -2 Years, Maximum - 4 Years)

To fulfil the requirements for acquiring the MSCAIML, a student may successfully complete each course of the programme in a minimum of 2 years and a maximum of 4 years.

1.2 Eligibility

Bachelor degree of at least 3 years duration from a recognized University/Institution. Mathematics at 10+2 level is desirable.

1.3 Medium of Instruction

The medium of instruction is English**.** The course material is in English.

1.4 Credit System

The University follows the 'Credit System' for its programmes. Each credit is worth 30 hours of student learning time comprising all the learning activities. Thus, a four-credit course involves 120 study hours. This helps the student to understand the academic effort one has to put for successful completion of a course. Successful completion of the programme requires successful completion of both assignments and the Term-End Examination of each course of the programme.

1.5 Exit Option

If a learner decides to EXIT from the programme after successful completion of all the courses of first two semesters (40 credits), then the learner is eligible for the award of Post Graduate Diploma in Artificial Intelligence and Machine Learning. However, to mention that there is no explicit admission for Post Graduate Diploma in Artificial Intelligence and Machine Learning.

1.6 Mode of Delivery

This programme is offered through the Open and Distance Learning (ODL) mode, wherein a Learner Support Centre (LSC) is assigned to facilitate both theoretical and practical counselling sessions.

1.7 Programme Structure

The MSCAIML is semester-based Programme. It has been divided into two semesters per year (July to December and January to June), with a balanced blend of theory and practical components:

- **Semester I and II** focus on building foundational knowledge and practical skills in core subjects such as Mathematics, Python Programming, Data Structures, Database Management Systems,

Artificial Intelligence, Machine learning, and Pattern Recognition. These courses emphasize strengthening the theoretical base and developing practical competence in essential machine learning tools and techniques.

- **Semester III and IV** are designed to deepen the conceptual understanding through advanced topics such as: Deep Learning, Digital Image Processing and Computer Vision, Cloud Computing, Natural Language Processing, Soft computing, and Reinforcement Learning. The final semester also includes project work that allows students to apply their knowledge to real-world challenges, fostering innovation and independent research.

Overall, the MSCAIML programme aims to develop skilled professionals capable of addressing complex artificial centric problems using cutting-edge technologies and methodologies.

The University conducts Term End Examinations (TEE) twice a year during June and December. The students are at liberty to appear for the examinations subject to completing the minimum time framework and other criteria prescribed for the programme.

M.Sc. (ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING) PROGRAMME STRUCTURE

Semester I (20)				
Sr. No.	**Course Code**	**Course Title**	**Theory/ Practical**	**Credits**
1.	MCS-061	Mathematical Foundations-I	Theory	4
2.	MCS-208	Data Structures and Algorithms	Theory	4
3.	MCS-081	Artificial Intelligence	Theory	4
4.	MCS-082	Programming Using Python	Theory	4
5.	MCSL-209	Data Structures and Algorithms Lab	Practical	2
6.	MCSL-083	Programming & AI Lab	Practical	2
Semester II (20)				
1.	MCS-066	Mathematical Foundations –II	Theory	4
2.	MCS-084	Machine Learning	Theory	4
3.	MCS-085	Pattern Recognition	Theory	4
4.	MCS-207	Database Management Systems	Theory	4
5.	MCSL-086	Machine Learning and Pattern Recognition Lab	Practical	2
6.	MCSL-087	Database Management Systems Lab	Practical	2
Semester III (20)				
1.	MCS-072	Deep Learning	Theory	4
2.	MCS-230	Digital Image Processing and Computer Vision	Theory	4
3.	MCS-077	Natural Language Processing	Theory	4
4.	MCS-227	Cloud Computing & IOT	Theory	4
5.	MCSL-076	Deep Learning Lab	Practical	2
6.	MCSL-088	Digital Image Processing and Computer Vision Lab	Practical	2
Semester IV (20)				
1.	MCS-073	Soft Computing	Theory	4
2.	MCS-089	Reinforcement Learning	Theory	4
3.	MCSP-090	Project Work	Project	12

No. of Theory Courses– 14; No. of Practical Courses –6; Project – 1; Total Credits: 80;
Total number of Courses are 21.

1.8 Recognition

IGNOU is a Central University established by an Act of Parliament in 1985 (Act No.50 of 1985) IGNOU Degrees/Diplomas/Certificates are recognized by all member Universities of Association of Indian Universities (AIU) and are at par with Degrees/Diplomas/Certificates of all Indian Universities/Deemed Universities/Institutions vide UGC Circular No. F1-52/2000 (CPP-II) dated 5 May, 2004 and AIU Circular No. EV/B (449)/94/177115 dated January 14, 1994, and UGC's letter no. UGC/DEB/2013 dated 14.10.2013, and UGC notification on UGC website F.No. 1-18/2018 (DEB-I) dated 21-02-2019. You may download all the recognition related information from the IGNOU's website.

1.9 Student Support Services

To provide individualized support to its learners, the University has created a number of Learner Support Centres (LSCs) throughout the country for this Programme. These are administratively coordinated by the Regional Centres (RCs). The LSCs are the contact points for the students on all major aspects of the Programme. These include counselling sessions, practical sessions, reference library facilities, disseminating information and advice, facilities for audio-visual training aids and teleconferencing.

The University may not always be able to communicate to all the students individually. All the important communications are sent to the Regional Directors who in turn will intimate them to the LSC Coordinators. The Coordinators display such Circulars / Notifications on their notice boards for the benefit of the students. You are, therefore, advised to be in touch with your LSC Coordinator on a more regular basis so as to get the latest information about assignments, submission schedules (assignments and examination forms), declaration of results, etc.

1.10 How to Contact the Programme Coordinator?

Students may contact the Programme Coordinator by sending a communication through post to The MSCAIML Programme Coordinator, SOCIS, Visveswaraya Bhavan, C-Block, IGNOU Academic Complex, IGNOU, Maidan Garhi, New Delhi – 110068, or can send an Email to mscaiml@ignou.ac.in

2. INSTRUCTIONAL SYSTEM

The methodology of instruction in this University is different from that of the conventional universities. The Open and Distance Learning (ODL) University system is more learner oriented, and the student has to be an active participant in the teaching-learning process. Most of the instruction is imparted through distance mode with only a small component of face-to-face communication. The University follows a multi-channel approach for instruction. It comprises a suitable mix of:

- ☞ Self-learning materials in pdf/printed form
- ☞ Audio-video programmes transmitted through GYAN DARSHAN channel
- ☞ Face-to-face counselling at LSC by academic counselors
- ☞ Compulsory practical sessions at the LSCs
- ☞ eGyankosh(for downloading self-learning materials)
- ☞ Web based academic support
- ☞ Assignments
- ☞ Gyan Darshan Channel, including teleconferencing,
- ☞ Gyan Vani
- ☞ SWAYAMPRABHA-DTH (Channel-13) – Professional Education

2.0 Self-learning Material

Self-learning materials are the primary form of instructional materials. These are supplied to the learners in the form of booklets having several blocks. Each block consists of several units. The size of a unit is such that the material given therein may be expected to be studied by a student in a session of about 4 to 6 hours of study. This self-learning material is made in electronic form through IGNOU eContent App and eGyankosh website. However, the fast pace of computer industry necessitates that students must do some additional readings. Students are advised to study reference books without fail. Studying the self-learning material alone may not be sufficient to write assignments and prepare for the Term-end Examinations.

2.1 eGyankosh, SWAYAMPRABHA-DTH (Channel-13) and IGNOU eContent App

eGyankosh **(www.egyankosh.ac.in)** is a digital repository consists of the reference links Self instructional materials, recorded videos, YouTube-video archives etc. Various links for the eGyankosh related to SOCIS are:

eGyankosh Homepage: https://www.egyankosh.ac.in/

Self-Learning Material: https://www.egyankosh.ac.in/handle/123456789/72348

YouTube-Video Archives: http://www.egyankosh.ac.in/handle/123456789/35748

EMPC YouTube Live/Playlists: https://www.youtube.com/@EMPCIGNOU/streams

SWAYAM PRABHA Channel 13, designated as "Professional Education," is a specialized educational television channel operating under the SWAYAM PRABHA initiative of the Ministry of Education, Government of India. This channel is coordinated by the Indira Gandhi National Open University (IGNOU), New Delhi, and is dedicated to delivering high-quality educational content to a nationwide audience.

The primary objective of Channel 13 is to provide learners with the knowledge and skills necessary for entry into specific professions or occupational sectors. It serves as a vital platform to bridge the gap between academic learning and the skill requirements of contemporary workplaces. By offering industry-relevant courses, the channel supports individuals in developing competencies for career advancement, while also addressing workforce development needs by contributing to a skilled talent pool for the nation.

Channel 13 broadcasts an extensive range of academic programs, including Certificate, Diploma, Postgraduate Diploma, Postgraduate Certificate, Undergraduate, and Postgraduate courses. These courses span various disciplines such as Computer Science and Applications, Management Studies, Journalism and New Media Studies, etc.

The video content, which is visually engaging and graphically enhanced, is delivered by faculty members of IGNOU as well as subject matter experts from other prestigious institutions across India. The channel operates on a 24x7 basis, with a minimum of four hours of fresh content broadcasted daily. Each session is repeated five times during the day, thereby ensuring flexible and convenient access for learners.

SWAYAM PRABHA homepage: https://www.swayamprabha.gov.in/

LIVE sessions of SWAYAMPRABHA: https://splive.ignouonline.ac.in/live/ch/13

Professional Education (Channel-13):https://swayamprabha.gov.in/program/current_he/13

Archive Videos:https://swayamprabha.gov.in/program/archive_he/13

IGNOU eContent App

The self-learning material of various programmes of IGNOU are made available through **IGNOU eContent APP**

https://play.google.com/store/apps/details?id=ac.in.ignou.Viewer&hl=en

2.2 Counselling Sessions

The details of the theory and practical counselling sessions are given in the following sections.

Theory Sessions

In distance education, face-to-face contact between the learners and their tutors/counsellors is relatively less. The purpose of such a contact is to answer some of your questions and clarify your doubts that may not be possible through any other means of communication. It also provides you with an opportunity to meet your fellow students.

There are academic counsellors at the LSC to provide counselling and guidance to you in the courses that you have chosen for study. Normally, these sessions will be held at the LSC on Saturdays and Sundays.

You should note that the counselling sessions would be very different from the classroom teaching or lectures. Counsellors will not be delivering lectures as in conventional teaching. They will try to help you to overcome difficulties that you face while studying for the MSCAIML programme. In these sessions, you must try to resolve your subject-based difficulties and any other related problems.

Practical Sessions and Compulsory Attendance

The practical sessions will be held in the computer centres/labs of the LSC. In these computer labs, the participants will have the facility to use the computer and software packages relevant to the syllabus. The following points regarding the practical attendance must be noted:

i) 75% attendance is compulsory for each lab course. This is a pre-requisite for taking the term-end practical examination in the respective lab courses.

ii) A student who fails to fulfil the 75% attendance requirements will be allowed to reregister for that lab course. For fee details and the application form, please contact your Regional Centre.

iii) Students are required to prepare a separate lab record for each lab course. The practical counsellor should duly sign this lab record after each session.

iv) Student attendance will be recorded course wise at the Learner Support Centre.

v) Strictly follow the guidelines given in the Lab manuals for the respective lab courses.

vi) Computer to Student ratio in a practical session would be 1:2. (2 students would be sharing a machine)

Before attending the counselling session for each course, please go through your course material as per the session schedule and make a plan of the points to be discussed. Unless you have gone through the Units, there may not be much to discuss and a counselling session may not be fruitful.

Counselling Sessions

The following is the counselling sessions for 1st to 4th Semesters of MSCAIML. **The respective Learner support centres (LSC) will communicate you the counselling schedule.**

1st Semester

Course Code	Course Title	Theory/Practical	Credits	No. of Theory Counselling Sessions*	Hours	No. of Practical Counselling Sessions**	Hours
MCS-061	Mathematical Foundations-I	Theory Sessions	4	6	12	-	-
MCS-208	Data Structures and Algorithms	Theory Sessions	4	6	12	-	-
MCS-081	Artificial Intelligence	Theory Sessions	4	6	12	-	-
MCS-082	Programming Using Python	Theory Sessions	4	6	12	-	-
MCSL-209	Data Structures and Algorithms Lab	Practical Sessions	2			20	60
MCSL-083	Programming & AI Lab	Practical Sessions	2	-	-	20	60

2nd Semester

Course Code	Course Title	Theory/Practical	Credits	No. of Theory Counselling Sessions*	Hours	No. of Practical Counselling Sessions**	Hours
MCS-066	Mathematical Foundation –II	Theory Sessions	4	6	12	-	-
MCS-084	Machine Learning	Theory Sessions	4	6	12	-	-
MCS-085	Pattern Recognition	Theory Sessions	4	6	12	-	-
MCS-207	Database Management Systems	Theory Sessions	4	6	12	-	-
MCSL-086	Machine Learning	Practical	2	-	-	20	60

	and Pattern Recognition Lab	Sessions					
MCSL-087	Database Management Systems Lab	Practical Sessions	2	-	-	20	60

3rd Semester

Course code	Course Title	Theory/Practical	Credits	No. of Theory Counselling Sessions*	Hours	No. of Practical Counselling Sessions**	Hours
MCS-072	Deep Learning	Theory Sessions	4	6	12	-	-
MCS-230	Digital Image Processing and Computer Vision	Theory Sessions	4	6	12	-	-
MCS-077	Natural Language Processing	Theory Sessions	4	6	12	-	-
MCS-227	Cloud Computing & IOT	Theory Sessions	4	6	12	-	-
MCSL-076	Deep Learning Lab	Practical Sessions	2	-	-	20	60
MCSL-088	Digital Image Processing and Computer Vision Lab	Practical Sessions	2	-	-	20	60

4th Semester

Course code	Course Title	Theory/Practical	Credits	No. of Theory Counselling Sessions*	Hours	No. of Practical Counselling Sessions	Hours
MCS-073	Soft Computing	Theory Sessions	4	6	12	-	-
MCS-089	Reinforcement Learning	Theory Sessions	4	6	12	-	-
MCSP-090	Project Work	Project	12	4	8	-	-

***Each theory counselling session is for 2 hours duration.**
****Each practical counselling session is for 3 hours duration.**

Semester	No. of Sessions		No. of Hours	
	Theory	**Practical**	**Theory**	**Practical**
I	24	40	48	120
II	24	40	48	120
III	24	40	48	120
IV	12 + 4 sessions for discussions on Project	-	24 + 8 = 32	-
TOTAL	**88**	**120**	**176**	**360**

Total Computer time for Practicals (120 Sessions) =360 Hours
Note: 75% attendance is compulsory in Practical Lab Sessions.

Session-wise topics to be covered*:*

1st Semester Schedule

MCS-061: Mathematical Foundations - I

Counselling Sessions

Sessions	Session Number	Topics to be Covered
Theory Counselling	1	All topics of Block-1 Unit-1 and Unit-2
	2	All topics of Block-1 Unit 3 and Unit-4
	3	All topics of Block-2 Unit-5, Unit 6 and Unit-7
	4	All topics of Block-3 Unit-8, Unit 9 and Unit-10
	5	All topics of Block-4 Unit-11, and Unit-12
	6	All topics of Block-4 Unit-13 and Unit-14

MCS-208 Data Structures and Algorithms

Counselling Sessions

Sessions	Session Number	Topics to be Covered
Theory Counselling	1	All topics of Block-1 Unit-1 and Unit-2
	2	All topics of Block-1 Unit-3, and Block-2 Unit-4
	3	All topics of Block-2 Unit-5 and Unit-6
	4	All topics of Block-3 Unit-7, Unit-8
	5	All topics of Block-3 Unit-9, and Block-4 Unit-10
	6	All topics of Block-4 Unit-11, and Unit-12

MCS-081 Artificial Intelligence

Counselling Sessions

Sessions	Session Number	Topics to be Covered
Theory Counselling	1	All topics of Unit-1, and Unit-2
	2	All topics of Unit-3, Unit-4
	3	All topics of Unit-5, and Unit-6
	4	All topics of Unit-7, and Unit-8
	5	All topics of Unit-9, Unit-10
	6	All topics of Unit-11, and Unit-12

MCS-082 Programming Using Python

Counselling Sessions

Sessions	Session Number	Topics to be Covered
Theory Counselling	1	All topics of Block-1 Unit-1, Unit-2 and Unit-3
	2	All topics of Block-1 Unit-4 Block-2 Unit-5
	3	All topics of Block-2 Unit-6, Unit-7 and Unit-8
	4	All topics of Block-2 Unit-9 Block 3 Unit-10, Unit-11
	5	All topics of Block-3 Unit-12, Block-4 Unit-13
	6	All topics of Block-4 Unit-14, Unit-15 and Unit-16

MCSL-209 Data Structures and Algorithms Lab

Counselling Sessions

Sessions	Session Number	Topics to be Covered
Practical Counselling	1-20	In each session, designated Exercises are to be done. Refer to MCSL-209 course material.

MCSL-083 Programming and AI Lab

Counselling Sessions

Sessions	Session Number	Topics to be Covered
Practical Counselling	1-10	Python Programming Lab
	11-20	AI Lab

2nd Semester Schedule

MCS-066: Mathematical Foundations - II

Counselling Sessions

Sessions	**Session Number**	**Topics to be Covered**
Theory Counselling	1	All topics of Unit-1, Unit-2 and Unit-3
	2	All topics of Unit-4 and Unit-5
	3	All topics of Unit-6 and Unit-7
	4	All topics of Unit-8 and Unit-9
	5	All topics of Unit-10 and Unit-11
	6	All topics of Unit-12 and Unit-13

MCS-084 Machine Learning

Counselling Sessions

Sessions	**Session Number**	**Topics to be Covered**
Theory Counselling	1	All topics of Block-1 Unit-1 and Unit-2
	2	All topics of Block-1 Unit-3, Block-2 Unit-4
	3	All topics of Block-2 Unit-5 and Unit-6
	4	All topics of Block-3 Unit-7 and Unit-8
	5	All topics of Block-3 Unit-9, Block-4 Unit-10
	6	All topics of Block-4 Unit-11 and Unit-12

MCS-085 Pattern Recognition

Counselling Sessions

Sessions	**Session Number**	**Topics to be Covered**
Theory Counselling	1	All topics of Block-1 Unit-1 and Unit-2
	2	All topics of Block-1 Unit-3, Block-2 Unit-4
	3	All topics of Block-2 Unit-5 and Unit-6
	4	All topics of Block-3 Unit-7 and Unit-8
	5	All topics of Block-3 Unit-9, Block-4 Unit-10
	6	All topics of Block-4 Unit-11 and Unit-12

MCS-207 Database Management Systems

Counselling Sessions

Sessions	Session Number	Topics to be Covered
Theory Counselling	1	All topics of Block-1 Unit-1, Unit-2 and Unit-3
	2	All topics of Block-1 Unit-4 Block-2 Unit-5
	3	All topics of Block-2 Unit-6, Unit-7 and Unit-8
	4	All topics of Block-2 Unit-9 Block 3 Unit-10, Unit-11
	5	All topics of Block-3 Unit-12, Block-4 Unit-13
	6	All topics of Block-4 Unit-14, Unit-15 and Unit-16

MCSL-086 Machine Learning and Pattern Recognition Lab

Counselling Sessions

Sessions	Session Number	Topics to be Covered
Practical Counselling	1-10	All topics of Machine Learning
	11-20	All topics of Pattern Recognition

MCSL-087 Database Management Systems Lab

Counselling Sessions

Sessions	Session Number	Topics to be Covered
Practical Counselling	1-20	All topics of Database Management Systems

3rd Semester Schedule

MCS-072: Deep Learning

Counselling Sessions

Sessions	Session Number	Topics to be Covered
Theory Counselling	1	All topics of Block-1 Unit-1 and Unit-2
	2	All topics of Block-1 Unit-3, Block-2 Unit-4
	3	All topics of Block-2 Unit-5 and Unit-6
	4	All topics of Block-3 Unit-7 and Unit-8
	5	All topics of Block-3 Unit-9, Block-4 Unit-10
	6	All topics of Block-4 Unit-11 and Unit-12

MCS-230 Digital Image Processing and Computer Vision
Counselling Sessions

Sessions	Session Number	Topics to be Covered
Theory Counselling	1	All topics of Block-1 Unit-1, Unit-2 and Unit-3
	2	All topics of Block-1 Unit-4, Block-2 Unit-5
	3	All topics of Block-2 Unit-6, Unit-7 and Unit-8
	4	All topics of Block-3 Unit-9 and Unit-10
	5	All topics of Block-3 Unit-11 Block-4 Unit-12
	6	All topics of Block-4 Unit-13 and Unit-14

MCS-077 Natural Language Processing
Counselling Sessions

Sessions	Session Number	Topics to be Covered
Theory Counselling	1	All topics of Block-1 Unit-1, Unit-2 and Unit-3
	2	All topics of Block-1 Unit-4, Unit-5 and Unit 6
	3	All topics of Block-2 Unit-7, and Unit 8
	4	All topics of Block-2 Unit-9 and Block -3 Unit-10
	5	All topics of Block-3 Unit-11 and Unit-12
	6	All topics of Block-4 Unit-13, Unit-14 and Unit-15

MCS-227 Cloud Computing & IOT
Counselling Sessions

Sessions	Session Number	Topics to be Covered
Theory Counselling	1	All topics of Block-1 Unit-1 and Unit-2
	2	All topics of Block-1 Unit-3 Block-2 Unit-4
	3	All topics of Block-2 Unit-5, Unit-6 and Unit-7
	4	All topics of Block-3 Unit-8
	5	All topics of Block-3 Unit-9, Block-4 Unit-10
	6	All topics of Block-4 Unit-11 and Unit-12

MCSL-076: Deep Learning Lab
Counselling Sessions

Sessions	Session Number	Topics to be Covered
Practical Counselling	1-20	All topics of Deep Learning Lab

MCSL-088 Digital Image Processing and Computer Vision Lab

Counselling Sessions

Sessions	Session Number	Topics to be Covered
Practical Counselling	1-20	***Digital Image Processing and Computer Vision Lab***

4th Semester Schedule

MCS-073: Soft Computing
Counselling Sessions

Sessions	Session Number	Topics to be Covered
Theory Counselling	1	All topics of Block-1 Unit-1 and Unit-2
	2	All topics of Block-1 Unit-3 Block-2 Unit-4
	3	All topics of Block-2 Unit-5 and Unit-6
	4	All topics of Block-3 Unit-7 and Unit-8
	5	All topics of Block-3 Unit-9 Block-4 Unit-10
	6	All topics of Block-4 Unit-11 and Unit-12

MCS-089 Reinforcement Learning

Counselling Sessions

Sessions	Session Number	Topics to be Covered
Theory Counselling	1	All topics of Unit-1 and Unit-2
	2	All topics of Unit-3 and Unit-4
	3	All topics of Unit-5 and Unit-6
	4	All topics ofUnit-7 and Unit-8
	5	All topics of Unit-9 and Unit-10
	6	All topics of Unit-11 and Unit-12

2.3 Web Based Support

The learners can have access to IGNOU's website at the following address (URL): ***https://www.ignou.ac.in/.*** You can download assignments, old question papers, circulars, etc. from the website. The Programme Guide is also available at the website. Section 3 gives you how to browse the IGNOU's website.

3. SYLLABUS

SEMESTER - I

1. MCS-061 Mathematical Foundation – I
Credits – 4

Syllabus: Set, Relations , Functions, Graphical Representation of Function, Progressions ,Matrices, Determinants, Linear Spaces, Counting Techniques, Limit and Continuity, Differentiation and Integration.

Blocks and Units Structure:

Block-1: Sets , Relations and Functions

Unit -1 : Introduction to Sets
1.0 Introduction
1.1 Objectives
1.2 Set
1.2.1 Concept of Set
1.2.2 Methods of Representing a Set
1.2.3 Relationships between Sets
1.2.4 Cardinality of a Set
1.2.5 Subsets
1.2.6 Power of Sets
1.3 Types of Sets
1.4 Hierarchy of Sets
1.5 Venn Diagrams
1.6 Set Operations
1.6.1 Different Set Operations
1.6.2 Convex Set
1.6.3 Russell's Paradox
1.6.4 Intervals
1.7 Ordered Pairs and Cartesian Products
1.7.1 Cartesian Products
1.8 Some Useful and Important Laws
1.9 Application of Sets
1.10 Summary
1.11 Solutions/Answers
1.12 References/Further Readings

Unit -2: Relations
2.0 Introduction
2.1 Objectives
2.2 Relations
2.2.1 Definition, Notation and Illustrations
2.3 Properties of Relations
2.4 Equivalence relations, and Partition of a Set
2.5 Partial Order Relation, Partially Ordered Set
2.5.1 Applications of Equivalence Relation and Partition of a Set
2.5.2 Partial Order Relation, Partially Ordered Sets
2.6 Operations on Relations
2.6.1 Set-type Operations on Relations
2.6.2 Mapping-type operations: inverse of operations, compositions
2.6.3 Closure Operations
2.7 Summary
2.8 Solutions/Answers
2.9 References/ Further Readings

Unit-3: Functions
3.0 Introduction
3.1 Objectives
3.2 Quantity
3.3 Interval
3.4 Function
3.4.1 Mapping
3.4.2 Pictorial Presentation of Functions
3.4.3 Operations on Functions
3.4.4 Some Commonly Used Functions
3.4.5 Monotonic Functions
3.5 Types of functions Based on Mapping
3.5.1 Injective Function
3.5.2 Surjective Function
3.5.3 Bijective Function
3.5.4 Geometrical Meaning of Injective, Surjective and Bijective Functions
3.6 Inverse of Functions
3.7 Summary
3.8 Solutions/Answers
3.9 References/ Further Readings

Unit -4: Graphical Representation of Function
4.0 Introduction
4.1 Objectives
4.2 Vertical Line Test of Function
4.2.1 Relationship between Equation and Function
4.2.2 Co-ordinate Geometry
4.2.3 Cartesian Co-ordinate System

1. Discrete Mathematical Structures By Bernard Kolman , Robert C. Busby , Sharon Cutler Ross , PHI 2002
2. Mathematics Class XI By RD Sharma , Dhanpat Rai Publication , 2011
3. Mathematics Class XI By Ravi Prakash , GRB Books, Edition 2025
4. Mathematics Class XII Part – 2 By Ravi Prakash , GRB Books, Second Edition 2025

2. Data Structures and Algorithms (MCS-208) Credits – 4

BLOCK-1: Introduction to Algorithms and Data Structures

Unit -1: Analysis of Algorithms
- Mathematical Background
- Process of Analysis
- Calculation of Storage Complexity
- Calculation of Run Time Complexity

Unit -2: Arrays, Pointers and Structures
- Arrays and Pointers
- Sparse Matrices
- Structures
- Polynomials
- Representation of Arrays
  - Row Major Representation
  - Column Major Representation
- Applications

Unit -3: Lists
- Abstract Data Type-List
- Array Implementation of Lists
- Linked Lists-Implementation
- Doubly Linked Lists-Implementation
- Circularly Linked Lists-Implementation
- Skiplists
- Applications

BLOCK- 2: Stacks, Queues and Trees

Unit -4: Stacks
- Abstract Data Type-Stack
- Implementation of Stack
  - Implementation of Stack using Arrays
  - Implementation of Stack using Linked Lists
- Algorithmic Implementation of Multiple Stacks
- Applications

Unit -5: Queues
- Abstract Data Type-Queue
- Implementation of Queue
  - Array Implementation
  - Linked List Implementation
- Implementation of Multiple Queues
- Implementation of Circular Queues
  - Array Implementation
  - Linked List Implementation of a circular queue, Priority Queues
- Implementation of DEQUEUE
  - Array Implementation of a dequeue
  - Linked List Implementation of *a dequeue*

Unit -6: Trees
- Abstract Data Type-Tree
- Implementation of Tree
- Tree Traversals
- Binary Trees
- Implementation of Binary Tree
- Binary Tree Traversals
  - Recursive Implementation of Binary Tree Traversals
  - Non Recursive Implementations of Binary Tree Traversals
- Applications

BLOCK -3: Graph Algorithms and Searching Techniques

Unit -7: Advanced Trees
- Binary Search Trees
  - Traversing a Binary Search Trees
  - Insertion of a node into a Binary Search Tree
  - Deletion of a node from a Binary Search Tree
- AVL Trees
  - Insertion of a node into an AVL Tree
  - Deletion of a node from and AVL Tree
  - AVL tree rotations
  - Applications of AVL Trees
- B-Trees
  - Operations on B-Trees
  - Applications of B-Trees
- Splay Trees
  - Splaying steps
  - Splaying Algorithm
- Red-Black trees
  - Properties of a Red-Black tree
- AA-Trees

Unit -8: Graphs
- Definitions
- Shortest Path Algorithms
  - Dijkstra's Algorithm
  - Graphs with Negative Edge costs
  - Acyclic Graphs

- All Pairs Shortest Paths Algorithm
- Minimum cost Spanning Trees
  - Kruskal's Algorithm
  - Prims's Algorithm
  - Applications
- Breadth First Search
- Depth First Search
- Finding Strongly Connected Components

Unit -9: Searching and Sorting Techniques

- Linear Search
- Binary Search
- Applications
- Internal Sorting
  - Insertion Sort
  - Bubble Sort
  - Quick Sort
  - 2-way Merge Sot
  - Heap Sort
- Sorting on Several Keys
- External Sorting Algorithms

BLOCK -4: File Structures and Advanced Data Structures

Unit -10 : Hashing

- Introduction
- Index Mapping
- Collision Handling
- Double Hashing
- Load Factor and Rehashing

Unit -11: Advanced Data Structures

- Scapegoat Trees
- Tries
- Binary Tries
- X-Fast Tries
- Y-Fast Tries

Unit -12: File Structures

- Terminology
- File Organisation
- Sequential Files
  - Structure
  - Operations
  - Disadvantages
  - Areas of use
- Direct File Organisation
- Indexed Sequential File Organisation

Reference Books:

1. Open Data Structures by Pat Morin , Athabasca University Press, http://www.aupress.ca/index.php/books/120226
2. Algorithms+Data Structures = Programs by Niklaus Wirth; PHI
3. Data Structures and Algorithms by Aho, Ullman, and Hopcroft; Addison-Wesley
4. Design and Analysis of Computer Algorithms by Aho; Pearson Education
5. Fundamentals of Data Structures by Ellis Horowitz, and Sartaj Sahni; Computer Science Press
6. Data Structures and Algorithm Analysis in C by Mark A. Weiss; Pearson
7. The Science of Programming by David Gries; Springer
8. An Introduction to Data Structures with Application by Jean-Paul Tremblay, and Paul Sorrenson; Mc Graw Hill Edition
9. The C Programming Language by Brian W. Kernighan, and Dennis Ritchie; Pearson Education

3. MCS-081: Artificial Intelligence

Credits – 4

Block-1 : Artificial Intelligence - Introduction :

Unit-1: Introduction to Artificial Intelligence

What is AI? Examples of AI systems, Approaches to AI, Brief history of AI, Turing Test, Chinese Room Argument, components of intelligence, Symbolic vs Connectionist AI, Introduction to Machine Learning and Deep Learning, Intelligent Agent, Application Areas of Artificial Intelligence Systems.

Unit-2: Problem Solving using Search

Single agent search: Introduction to State Space Search, Statement of Search problems: state space graphs, Searching explicit state spaces. Feature based state spaces. Problem types, examples (puzzle problem, n-queen, the road map) Two agent search: Adversarial search: Two agent games (alpha-beta pruning). Min-Max Search.

Unit-3: Uninformed and Informed Search

Uninformed Search: Formulating the state space, iterative deepening, bidirectional search. Informed Search Strategies: Using evaluation functions. A* & AO*,

admissibility of A*, Iterative deepening A*, recursive best first search.

Block-2: Artificial Intelligence - Knowledge Representation:

Unit-4: Predicate and Propositional Logic–
Propositional logic, syntax, semantics, semantic rules, terminology- validity, satisfiability. interpretation, entailment, proof systems. Propositional Logic inference rules, natural deduction, propositional resolution.

Unit-5: First Order Logic -
First Order Logic: Motivation, Syntax, Interpretations, semantics of quantifiers, Entailment in FOL, Interpretation, Inference in FOL: First Order resolution. Conversion to clausal form. Unification. Most general unifier. Resolution with variables Proving validity.

Unit-6: Rule based Systems and other formalism -
Rule Based Systems: Forward chaining. Backward chaining. Probability Certainty Factors in Rule Based Systems, Conflict resolution. Semantic nets, Frames, Scripts.

Block -3: Artificial Intelligence –Decision Making

Unit-7: Probabilistic Reasoning

Reasoning with uncertain information Review of Probability Theory, Introduction to Bayesian Theory, Bayes' Networks, Probabilistic Inference, Basic idea of inferencing with Bayes networks. Other paradigms of uncertain reasoning. Dempster-Scheffer Theory

Unit -8: Decision-Making
Basics of utility theory, decision theory, sequential decision problems, elementary game theory, sample applications

Unit -9: Expert Systems

An Introduction to Expert Systems, Concept of Planning, Representing and using Domain Knowledge, Examples of Expert Systems: MYCIN, COMPASS, Expert System Building Tools, Some Application Areas of Expert Systems

Block -4: Implementation and Applications of AI

Unit -10: Intelligent Agents

Definitions, Agents and Rationality: Rationality vs. Omniscience, Autonomy and learning capability of the agent, Example: A boundary following robot; Task Environment of Agents: PEAS (Performance, Environment, Actuators, Sensors), Example An Automated Public Road Transport Driver, Different Types of Task Environments, Some Examples of Task Environments; The Structure of Agents: SR (Simple Reflex) Agents, Model Based reflex Agents, Goal-based Agents, Utility-based Agents; Different Forms of Learning in Agents.

Unit -11: AI Programming with Python
Introduction to Python for AI (NumPy, Pandas, Matplotlib,Scikit-learn, Pytorch,TensorFlow), Hands on implementation of: N-Queen Problem, Min-Max Algorithm, Alpha-Beta Pruning, Breadth First Search, Depth First Search, Best First Search, A* Algorithm, AO* Algorithm, Iterative Deepening A*, Model Evaluation and Hyperparameter Tuning in Python.

Unit -12: Applications of AI
AI in healthcare: Diagnosis, treatment, and medical imaging, AI in finance: Fraud detection, algorithmic trading, and risk assessment, AI in transportation: Autonomous vehicles and traffic optimization, AI in customer service and chatbots, AI in education: Personalized learning and intelligent tutoring systems.

Reference Books:

1. Artificial Intelligence – A Modern Approach (4th Edition), By Stuart Russell & Peter Norvig, Prentice Hall Publication, 2022.
2. Artificial Intelligence by Patrick Henry Winston, Pearson Education.
3. Artificial Intelligence (3rd Edition) by Kevin Knight, Elaine Rich, Shivashankar B. Nair, TMH publication 2017.

4. MCS-082: Programming Using Python
Credits – 4

Block-1: Introduction to Python Programming

Unit-1: Introduction to Python

1.0 Introduction
1.1 Objectives
1.2 History of Python
1.3 Need of Python
1.4 Packages for Cross platform application of Python
1.5 Getting started with Python
1.6 Program structure in python
1.7 Running the First program
1.8 Summary
1.9 Solution to Check your Progress
1.10 References/ Further Reading

Unit-2: Data Structures in Python

2.1 Introduction
2.2 Objectives
2.3 Identifiers and Keywords
2.4 Statements and Expressions
2.5 Variables
2.6 Operators
2.7 Data Types
- 2.7.1 Number
- 2.7.2 String
- 2.7.3 None
- 2.7.4 List
- 2.7.5 Tuple
- 2.7.6 Dictionary
- 2.7.7 Set

2.8 Data Structures
- 2.8.1 List
  - 2.8.1.1 Indexing and Slicing in Lists
  - 2.8.1.2 List Operations
  - 2.8.1.3 The list () function
  - 2.8.1.4 Modifying items in Lists
  - 2.8.1.5 Traversing a list
  - 2.8.1.6 List Methods
  - 2.8.1.7 Built-In Functions Used on Lists
  - 2.8.1.8 Nested List
- 2.8.2 Tuple
  - 2.8.2.1 Creating Tuples
  - 2.8.2.2 Basic Tuple Operations
  - 2.8.2.3 The tuple() Function
  - 2.8.2.4 Built-In Functions Used on Tuples
  - 2.8.2.5 Tuple assignment
  - 2.8.2.6 Relation between Tuples and Lists
  - 2.8.2.7 Tuple Methods
- 2.8.3 Dictionaries
  - 2.8.3.1 Built –In Functions Used on Dictionaries
  - 2.8.3.2 Dictionary Methods
  - 2.8.3.3 Relation between Tuples and Dictionaries
- 2.8.4 Sets
  - 2.8.4.1 Set Methods
  - 2.8.4.2 Traversing of Sets
  - 2.8.4.3 Frozen set

2.9 Summary
2.10 Solution to Check your Progress
2.11 References/ Further Reading

Unit-3: Python's Control Flow Structures

3.1 Introduction
3.2 Objectives
3.3 Control Flow Statements
- 3.3.1 Sequential Control Flow Statements
- 3.3.2 Decision Control Flow Statements
  - 3.3.2.1 The if Decision Control Flow Statement
  - 3.3.2.2 The if…else Decision Control Flow Statement
  - 3.3.2.3 The if…elif…else Decision Control Statement
  - 3.3.2.4 Nested if Statement
- 3.3.3 Loop Control Flow Statements
  - 3.3.3.1 The while loop
  - 3.3.3.2 The for loop
  - 3.3.3.3 The continue and break Statements

3.4 Summary
3.5 Solution to Check your Progress
3.6 References/ Further Reading

Unit-4: Functions and File Handling in Python

4.0 Introduction
4.1 Objectives
4.2 Function definition and calling
- 4.2.1 Creating user defined functions

4.3 Function Scope

11.6 CSV files in Python
11.7 Summary
11.8 Solutions to Check your Progress
11.9 References/ Further Reading

Unit-12: Python Advanced Concepts
12.0 Introduction
12.1 Objectives
12.2 Decorators
12.3 Iterators
12.4 Generators
13.5 Co-routines
12.6 Summary
12.7 Solution to Check your Progress
12.8 References/ Further Reading

Block-4: SomeUseful Python Libraries

Unit -13: NumPy
13.0 Introduction
13.1 Objectives
13.2 Overview of NumPy Library
- NumPy's Module Structure

13.3 NumPy Arry Objects and Functions
- numpy.ufunc

13.4 Math Operations
13.5 Trigonometric Functions
13.6 Bit-twiddling functions
13.7 Comparison functions
13.8 Floating functions
13.9 Summary
13.10 Solution to Check your Progress
13.11 References/Further Reading

Unit-14: Pandas -1
14.0 Introduction
14.1 Objectives
14.2 Overview of PANDAS Library
14.3 Key Features of Pandas
14.4 Benefits of Pandas
14.5 Python Pandas Series
14.6 Python Pandas DataFrame
14.7 Create a DataFrame from Lists
14.8 Create a DataFrame from Dict of Series
- *Column Selection/Delition*
- *Row Selection, Addition, and Deletion*

14.9 Python Pandas DataFrame Functions
14.10 Summary
14. 11 Solution to Check your Progress
14.12 References/ Further Reading

Unit-15: Pandas -2
15.0 Introduction
15.1 Objectives
15.2 Python Pandas Reading Files
- *Reading from JSON*
- *Reading from the SQL database*
- Reading from CSV and Excel

15.3 Pandas Concatenation
15.4 Python Pandas Data operations
- Row and column selection
- Filter Data

15.5 Data processing
- Hierarchical indexing
- Partial indexing
- Unstack the data
- Column indexing
- Swap and sort level

15.6 Pandas DataFrame.corr()
15.7 Pandas DataFrame.dropna()
15.8 Pandas DataFrame.fillna()
15.9 Pandas DataFrame.replace()
15.10 Pandas DataFrame.iloc[]
15.11 Pandas DataFrame.isin()
15.12 Pandas DataFrame.loc[]
15.13 Some other useful methods
15.14 Summary
15. 15 Solution to Check your Progress
15.16 References/ Further Reading

Unit-16: Graph Plotting using Matplotlib
16.0 Introduction
16.1 Objectives
16.2 Overview of Matplotlib
16.3 Basic Concepts and Terminology
- *Basic Components or Parts of Matplotlib Figure*

16.3 Key Features of Matplotlib
16.4 Different Types of Plots in Matplotlib
16.5 Creating Plots
16.6 Pyplot in Matplotlib
16.7 Matplotlib – Axes Class
16.8 Summary
16.9 Solution to Check your Progress
16.10 References/ Further Reading

References:

1. Python for Programmers by Paul Deitel and Harvey Deitel, Pearson India Edu. Serv.Pvt. Ltd , 2020.

2. Python Programming by S. Seridhar, J. Indumathi, and V. M. Hariharan, Pearson India Edu. Serv. Pvt. Ltd , 2023.
3. Python Programming a Modular Approach by Sheetal Taneja and Naveen Kumar, Pearson India Edu. Serv.Pvt. Ltd , 2018.

5. MCSL – 209: Data Structures and Algorithms Lab

Credits – 2

Objectives:

Main objective of this laboratory course is to provide hands on exercises to the learners based on Data Structures and Algorithms course.

Lab Sessions:

- There will be 20 practical sessions (3 hours each) of which 10 sessions will be on Data Structures Programming and 10 sessions will be on Algorithms
- The practice problems for all 20 sessions will be listed session-wise in the lab manual.

Block: Data Structures and Algorithms Lab
Section 1: Data Structures Lab
Section 2: Algorithms Lab

6. MCSL-083: Programming and AI Lab

Credits – 2

Objectives:

Objective of this course is to provide hands-on practice in problem solving using Python and implement some AI algorithms.
There will be 20 practical sessions (3 hours each) of which 10 sessions will be on Python Programming and 10 sessions will be on Artificial Intelligence.

Section -1: Python Programming Lab
10 sessions based on Programming using Python course (MCS-082)

Section -2: AI Lab
10 sessions based on Artificial Intelligence course (MCS-081)

SEMESTER –II

1. MCS-066: Mathematical Foundations II

Credits – 4

Block -1: Descriptive Statistics

Unit -1: Introduction to Statistics
What is statistics? Measurement Scale (Nominal, Ordinal Scale), Data Collection, Descriptive Statistics, Inferential Statistics and Probability Models, Population Saving, Population and Sampling Population Parameters

Unit -2: Describing data Sets and Measures of Central Tendencies
Describing Data Sets, Frequency Tables and Graphs, Relative Frequency Tables and Graphs, Grouped Data, Histograms, Ogives, and Stem and Leaf Plots, Sample Mean, Sample Median, and Sample Mode, Sample Percentiles and Box Plots

Unit -3: Measures of Dispersion
Variance, Standard Deviation, Skewness Kurtosis, Other measures of dispersion, Normal Data Sets

Block -2: Probability and Distributions

Unit -4: Basics of Probability
Sample Space and Events, Venn Diagrams, Axioms of Probability, Sample Spaces, Conditional Probability, Bayes' Formula, Independent Events

Unit -5: Random Variables and Expectation
Random Variables, Types of Random Variables, Jointly Distributed Random Variables, Expectation
Variance
Covariance and Variance of Sums of Random Variables
Moment Generating Functions
Chebyshev's Inequality and the Weak Law of Large Numbers

Unit -6: Discrete Probability Distributions
The Bernoulli and Binomial Distribution
The Poisson Distribution

The Hypergeometric Distribution
The Poisson Process

Unit -7: Continuous Probability Distribution
The Uniform Distribution
Normal Random Variables
The Chi-Square Distribution
The t-Distribution
The F-Distribution

Block -3: Parameter Estimation and Hypothesis Testing

Unit -8: Sampling Distribution
The Sample Mean
The Central Limit Theorem
Approximate Distribution of the Sample Mean
How is Large a Sample Needed?
The Sample Variance
Distribution of the Sample Mean
Joint Distribution of $\bar{X}$ and S2

Unit -9: Estimating Parameter
Maximum Likelihood Estimators
Confidence Interval
Point Estimator
Estimating the Difference in Means of Two Normal Populations
Approximate Confidence Interval for the Mean of a Bernoulli
The Bayes Estimator

Unit -10: Hypothesis Testing
Significance Levels
Tests regarding Mean of a Normal Population
t-Test
z-Test
Testing of Means of Two Normal Populations
hypothesis Test in Bernoulli Populations

Block -4: Analysing data and Optimisation

Unit -11: Analysis of Variance
One-Way Analysis of Variance
Two-Factor Analysis of Variance
Two-Factor Analysis of Variance

Unit -12: Categorical Data Analysis
Goodness of Fit Tests
Tests of Independence
Tests of Independence
The Kolmogorov – Smirnov Goodness of Fit Test
Radon Test

Unit -13: Introduction to Optimisation
Gradient Descent
Gradient Ascent
Stochastic Gradient Descent
Randomisation
Local and Global Minima

Reference:
"Introduction to Probability and statistics for engineers and scientists" 3rd Edition, Sheldon M. Ross, Elsevier Academic Press, 2004

2. MCS-084 Machine Learning

Credits – 4

Block-1: Fundamentals of Machine Learning

Unit-1: Introduction to Machine Learning
Definition and Scope of Machine Learning, History and Evolution of Machine Learning, Types of Machine Learning: Supervised Learning, Unsupervised Learning and Reinforcement Learning, Applications of Machine Learning: Healthcare, Finance, Marketing, etc.

Unit-2: Understanding Data and its Types
Introduction, Objectives, Properties of Data, Datafication, Data Categories: Qualitative & Quantitative data; Data Formats: Structured, Unstructured and Semi Structured data; Primary data & secondary Data, Categorical data & Numerical data, Cross-sectional data & Time series data, Discrete data & Continuous Data, Levels of Measurement of Data: Nominal, Ordinal, ratio and Interval data scales, Big Data, Summary, Solutions/Answers, Further Readings.

Unit -3: Data Preprocessing
Introduction, Objectives, Need for Data Preparation, Data preprocessing, Data Cleaning, Data Integration, Data Reduction, Data Transformation, Selection and Data Extraction, Data Curation Steps of Data Curation, Importance of Data Curation, Data Integration, Data Integration Techniques, Data Integration Approaches, Knowledge Discovery, Summary, Solutions/Answers Further Readings

Block-2: Supervised Learning Algorithms

Unit-4: Concept of Target Variables, Features, and Labels, Applications of Supervised Learning (Classification and Regression), Techniques of Supervised Learning, Classification Techniques - I: Introduction to Classification, Algorithms: Naïve Bayes, K-Nearest Neighbors (K-NN),

Unit–5: Classification Techniques – II: Decision Trees, Logistic Regression, and Introduction to Support Vector Machines (SVM) with Kernels, Evaluation Metrics: Confusion Matrix, Precision, Recall, F1-Score, ROC-AUC.

Unit-6: Regression Techniques: Introduction to Regression, Linear Regression (Simple and Multiple), Polynomial Regression, Support Vector Regression (SVR), and Evaluation Metrics: Mean Absolute Error, Mean Squared Error, R-squared.

Block-3: Unsupervised Learning and Clustering

Unit-7: Introduction to Unsupervised Learning: What is Unsupervised Learning?, Applications: Anomaly Detection, Clustering, Market Segmentation, Key Concepts: No Target Variable, Discovery of Hidden Patterns.

Unit-8: Clustering Techniques: Introduction to Clustering, Partition-Based Clustering (K-Means), Centroid Initialization (Lloyd's Algorithm), Elbow Method, Silhouette Score for Optimal K,

Unit-9: Hierarchical Clustering (Agglomerative, Divisive), Dendrogram Construction, Linkage Methods (Single, Complete, Average), Density-Based Clustering (DBSCAN): Core Points, Arbitrary Shape Handling, Noise, Parameter Selection (eps, min_samples), Introduction to Fuzzy Clustering.

Block-4: Model Evaluations and Machine Learning Applications

Unit-10: Association Rules – Introduction to Pattern search and its algorithms: Apriori Algorithms and its variants, FP Tree Growth, Pincer Search.

Unit-11: Model Evaluation and Hyper parameter Tuning: Cross-Validation Techniques (K-Fold, Leave-One-Out), Hyper-parameter Tuning (Grid Search, Random Search), and Regularization Techniques: Lasso and Ridge Regression, Dropout in Neural Networks, Model Over-fitting and Under-fitting.

Unit-12: Machine Learning Programming with Python: Introduction to Python for Machine Learning (NumPy, Pandas, Scikit-learn), Hands-on Implementation of: Linear Regression and Logistic Regression, Decision Trees and Random Forests, K-Means Clustering, PCA for Dimensionality Reduction, Model Evaluation and Hyperparameter Tuning in Python.

References:

1. Pattern Recognition and Machine Learning by Christopher M. Bishop
2. Reinforcement Learning: An Introduction by Richard S. Sutton and Andrew G. Barto
3. Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow by AurélienGéron
4. Applied Predictive Modeling by Max Kuhn and Kjell Johnson
5. Machine Learning: A Probabilistic Perspective by Kevin P. Murphy
6. Data Mining: Concepts and Techniques by Jiawei Han, Micheline Kamber, and Jian Pei
7. Ensemble Methods: Foundations and Algorithms by Zhi-Hua Zhou

Tools & Libraries:

- Python, Scikit-learn, TensorFlow, Keras

3. MCS-085: Pattern Recognition

Credits- 4

Block-1: Pattern Recognition – An Introduction

Unit-1: Introduction to Pattern Recognition

- **Introduction to Pattern Recognition**: Definition, historical background, and basic terminology.
- **Examples of Pattern Recognition Applications**: Speech recognition, image classification, medical diagnostics, etc.

- **Overview of Approaches**: Statistical, structural, neural networks.
- **Stages of Pattern Recognition**: Sensing, feature extraction, classification, and post-processing.

Unit-2: Bayesian Decision Theory

- **Probability Review**: Basic probability theory, joint and conditional probabilities, Bayes' theorem.
- **Bayesian Decision Making**: Optimal decision-making framework, minimizing error rates.
- **Discriminant Functions**: Decision rules for classification, likelihood ratio tests.
- **Risk and Loss Functions**: Minimizing expected risk, decision surfaces.
- **Error Probability**: Estimating error rates and setting thresholds.

Unit-3: Classifiers, Decision Regions, and Boundaries

- **Linear Discriminant Functions**: Geometry of decision regions, decision boundaries for linear classifiers.
- **Minimum Distance Classifier**: Euclidean distance measures, nearest prototype classification.
- **Perceptron Learning Algorithm**: Linear separability, perceptron convergence theorem.

Generalized Linear Models: Logistic regression, softmax classifiers.

Block-2: Parametric, Non-Parametric Techniques and Discriminant Functions

Unit-4: Maximum-Likelihood and Bayesian Parameter Estimation

- **Parameter Estimation Methods**: Maximum Likelihood Estimation (MLE), Bayesian parameter estimation.
- **Gaussian Classifiers**: Multivariate Gaussian distributions, covariance matrices, and their impact on decision boundaries.
- **Covariance Matrices and Decision Surfaces**: Properties of decision regions in Gaussian classifiers.
- **Bayesian Parameter Estimation**: Priors, posterior distribution, and decision-making.

Unit-5: Nonparametric Techniques for Density Estimation

- **Histograms**: Nonparametric estimation using histograms, advantages and limitations.
- **Kernel Density Estimation**: Parzen windows, smoothing parameters, and bandwidth selection.
- **k-Nearest Neighbor (k-NN) Classifiers**: Decision rule, relationship to density estimation.
- **Nonparametric Discriminant Analysis**: Techniques that avoid explicit density estimation.

Unit-6: Linear Discriminant Functions and Perceptrons

- **Linear Classifiers**: Formulation of linear discriminant functions, separating hyperplanes.
- **Learning Linear Classifiers**: Gradient descent, stochastic gradient descent.
- **Perceptron Algorithm**: Convergence theorem, practical implementations.
- **Multiclass Classification**: One-vs-one, one-vs-rest approaches for multiclass problems.

Block -3: SVM and Feature Engineering

Unit-7: Support Vector Machines (SVM)

- **Introduction to SVM**: Concept of maximizing the margin between classes.
- **Hard-Margin SVM**: Linear SVM for separable data, margin maximization.
- **Soft-Margin SVM**: SVM with slack variables for non-separable data.
- **Kernel Trick**: Using kernels to map data to higher-dimensional spaces for non-linear classification.

Unit-8: Non-Metric Methods and Prototype-Based Learning

- **Prototype-Based Learning**: Representing classes with prototypes.

- **k-Means Clustering**: Partitioning data into clusters, centroid computation.
- **Learning Vector Quantization (LVQ)**: Supervised version of vector quantization.
- **Self-Organizing Maps (SOM)**: Topological mappings in unsupervised learning.

Unit-9: Feature Extraction and Dimensionality Reduction

- **Principal Component Analysis (PCA)**: Dimensionality reduction by projecting data onto principal components.
- **Linear Discriminant Analysis (LDA)**: Maximizing class separability, Fisher's criterion.
- **Feature Selection Techniques**: Methods to select informative features.
- **Curse of Dimensionality**: Problems associated with high-dimensional spaces and strategies to handle it.
- **Expectation-Maximization (EM) Algorithm**: Parameter estimation for mixture models, convergence issues.

Block -4: Advanced Topics

Unit-10: Syntactic Pattern Recognition

- **Structural Pattern Recognition**: Patterns represented by symbolic data (e.g., strings, trees).
- **Formal Grammars and Languages**: Chomsky hierarchy, grammar-based pattern recognition.
- **Parsing Techniques**: Algorithms for syntactic pattern recognition, automata theory.

Unit-11: Hidden Markov Models (HMMs)

- **Introduction to HMM**: Markov processes, hidden states, and observable sequences.
- **Viterbi Algorithm**: Finding the most probable state sequence.
- **Forward-Backward Algorithm**: Estimating probabilities in HMMs.
- **Applications of HMM**: Speech and handwriting recognition, time series modeling.

Unit-12: Combining Classifiers

- **Combining Multiple Classifiers**: Methods for combining classifiers (voting, averaging).
- **Bagging and Boosting**: Techniques to improve classifier performance through ensemble methods.
- **Stacking**: Using meta-classifiers to combine base classifiers.
- **Classifier Diversity**: Importance of diversity in ensemble methods.

Reference Books:

1. *Pattern Classification* book by Richard O. Duda, Peter E. Hart, and David G. Stork, 2nd Edition, Wiley, 2021.
2. **"Pattern Recognition and Machine Learning"** by Christopher M. Bishop, Springer, 2009.
3. **"Pattern Recognition"** by Sergios Theodoridis and Konstantinos Koutroumbas, Elsevier, 2006.
4. **"Introduction to Statistical Pattern Recognition"** by Keith F. Manolessou

4. MCS-207: Database Management Systems

Credits – 4

Block- 1: Introduction to DBMS

Unit -1: Database Management System

An Introduction Need for a Database Management System Logical DBMS Architecture - Three level architecture of DBMS Mappings between levels and data independence Physical DBMS Structure - DML Precompiler, DDL Compiler, File Manager, Database Manager , Query Processor, Database Administrator, Data files indices and Data Dictionary Introduction to Different Data Models and Current Trends

Unit -2: Relational Database

The Relational Model (Domains, Attributes, Tuple and Relation, Super keys Candidate keys and Primary keys for the Relations) Relational Constraints, (Domain Constraint, Key Constraint, Integrity Constraint, Update Operations and Dealing with Constraint Violations) Relational Algebra (Basic Set Operation, Cartesian product, Relational Operations) Example of queries using relational algebra

Unit -3: ER Model
Entity Relationship (ER) Model (Entities, Attributes, Relationships) E-R Diagram Enhanced ER tools (Subclasses, Super class, and Inheritance, Specialization and Generalization, Constraints and Characteristics of Specialization and Generalization) Converting ER and EER diagram to tables

Unit -4: File Organisation in DBMS
Physical Database Storage of Database on Hard Disks File Organisation and Its Types Sequential File Organisation, Indexed File Organisation, Hashed File Organisation Types of Indexes, Index and Tree Structure, Multi-key File Importance of File 28 Organisation in Databases

Block -2: Normalization and Database Queries

Unit -5: Integrity, Functional Dependency and Normalization Relational Database Integrity (The Keys, Referential Integrity, Entity Integrity) Redundancy and Associated Problems Functional Dependencies Normalization (The First Normal Form, The Second Normal Form, The Third Normal Form, Boyce Codd Normal Form Desirable Properties of Decomposition with examples

Unit -6: Higher Normal Forms Multivalued dependency 4NF Join Dependency 5NF Introduction to other normal form

Unit -7: Structured Query language Data Definition Language Data Manipulation Language Data Control Language SQL Introduction Aggregate functions, Group by and having clause

Unit -8: ComplexQueries Joins Equijoin, self join, outer joins etc. Sub-queries and correlated subqueries Views, Sequences, Indexes, Synonyms Nested Queries

Unit -9: Advanced SQL Assertion and views Cursors, triggers and stored procedures Embedded SQL Dynamic SQL Advanced Features of SQL

Block -3: Database Transactions, Recovery and Security
Unit -10: Transaction Management The Transactions and its Properties The Concurrent Transactions and associated problems The Locking Protocol (Serialisable Schedules, Locks, Two Phase Locking (2PL) Deadlock and its Prevention Deadlock Handling, Optimistic Concurrency Control Timestamp based Protocol Multi-version Schemes Weak Levels of Consistency SQL commands for Transactions

Unit -11: Database Recovery and Security Recovery and Atomicity Recovery with Concurrent Transaction Checkpointing Buffer Management Levels of database security Access control Audit trails in the databases Relationship between Security and Integrity SQL support for recovery and security

Unit -12: Query Evaluation Measures of Query Cost (Selection Operation,, Sorting, Join Operation, other Operations) Evaluation of Expression Transformation of Relational Expressions Role of Relational Algebra in query optimization Estimating Statistics of Expression Choice of Evaluation Plans Views and query processing Storage and query optimization.

Block -4: Introduction to Advanced Database Models
Unit -13: Object Oriented Database
Unit -14: Distributed Database, Data Mining and Data Warehousing
Unit -15: NOSQL databases
Unit -16: Emerging Database Models

References:

"Database Management Systems" by R. Ramakrishnan and J. Gehrke

5. MCSL-086: Machine Learning and Pattern recognition Lab

Credits-02

Objective:

Objective of this course is to provide hands-on practice for Machine Learning and Pattern Recognition problems.

Lab Sessions:

- There will be 20 practical sessions (3 hours each) of which 10 sessions will be based on Machine Learning and 10 sessions will be on Pattern Recognition
- The practice problems for all 20 sessions will be listed session-wise in the lab manual.

Section -1: Machine Learning Lab
Based on Machine Learning course
Section -2: Pattern Recognition Lab
Based on Pattern Recognition Lab

6. MCSL-087: Database Management Systems Lab

Credits-02

Objective:

Main objective of this laboratory course is to provide hands on exercises to the learners based on Database Management Systemscourse.

Lab Sessions:

- There will be 20 practical sessions (3 hours each).
- The practice problems for all 20 sessions will be listed session-wise in the lab manual.

SEMESTER - III

1. MCS – 072: Deep Learning

Credits – 4

Block -1: Deep Learning Basics

Unit -1: Introduction to Deep Learning

- History of Deep Learning
- Deep Learning – An Introduction
- Applications of Deep Learning
- Limitations of Deep Learning
- Early Neural Network Models
  - McCulloch Pitts Neuron
  - Thresholding Logic
  - Perceptrons
  - Perceptron's Learning Algorithm and Convergence
  - Boltzmann Machines (New Addition)
- Multilayer Perceptrons (MLPs)
  - Representation Power of MLPs
  - Limitations of Linear Nets and Perceptrons
- Neural Networks and Their Applications
  - Sigmoid Neurons
  - Feed Forward Neural Networks
  - Different Layers of Neural Network
  - Loss Function
  - Backpropagation
  - Gradient Descent (GD)
  - Momentum Based GD
- Eigenvalues and Eigenvectors
  - Eigenvalue Decomposition
  - Principal Component Analysis (PCA)
  - Singular Value Decomposition (SVD)
- Advanced Techniques in Neural Networks
  - Parameter Sharing and Tying
  - Injecting Noise at Input
  - Ensemble Methods
  - Batch Normalization

Unit -2: Activation Functions

- Introduction to Activation Functions
- Different Activation Functions
- Sigmoid function
- Hyperbolic Tangent function
- ReLu - Rectified Linear Units
- Softmax function

Unit -3: Auto-Encoders and Regularization

- Auto-Encoders and their relation to PCA
- Regularization in Auto-Encoders
- Denoising Auto-Encoders
- Sparse Auto-Encoders
- Bias Variance Tradeoff
- L2 Regularization
- Early Stopping
- Dataset Augmentation
- Encoder Decoder Models
- Attention Mechanism

- Attention over images

Block -2: Deep Learning Models

Unit -4: Artificial Neural Networks (ANNs)

- Basics of artificial neural networks
- Perceptrons and activation functions
- Feedforward neural networks
- Training neural networks: gradient descent and backpropagation

Unit -5: Convolutional Neural Networks (CNNs)

- Introduction to convolutional neural networks
- CNN architecture and components
- Convolutional layers and filters
- Pooling layers and feature maps
- Popular CNN Model Architectures (LeNet, AlexNet, ZF-Net, VGGNet, GoogLeNet, ResNet)

Unit -6: Recurrent Neural Networks (RNNs)

- Introduction to recurrent neural networks
- RNN architecture and structure
- Long Short-Term Memory (LSTM) networks
- Gated Recurrent Units (GRUs)

Block 3: Advanced Topics in Deep Learning

Unit -7: Advanced Architectures

- Attention Mechanisms in Deep Learning
    - Introduction to attention mechanisms
    - Mechanisms for capturing context and relevance within input data
    - Applications in natural language processing, image captioning, and machine translation
- Transformer Architecture and Self-Attention
    - Overview of the Transformer architecture
    - Self-attention mechanism for capturing long-range dependencies
    - Transformer variants such as BERT, GPT, and T5
    - Applications in natural language understanding, generation, and summarization
- Capsule Networks
    - Introduction to capsule networks (CapsNets)
    - Hierarchical representation learning using capsules
    - Dynamic routing for routing-by-agreement
    - Applications in image recognition and understanding spatial relationships
- Deep Residual Networks (ResNets) and Skip Connections
    - Deep residual learning for addressing the vanishing gradient problem
    - Introduction to skip connections and identity mappings
    - Training deeper networks with improved convergence and performance
    - Applications in image classification, object detection, and semantic segmentation

Unit -8: Deep Reinforcement Learning

- Introduction to Reinforcement Learning (RL)
- Markov Decision Processes (MDPs)
- Q-Learning and Temporal Difference (TD) Learning
- Deep Q-Networks (DQN)
- Policy Gradient Methods
- Actor-Critic Methods
- Deep Deterministic Policy Gradient (DDPG)
- Advanced Topics in Deep RL

Unit -9: Deep Generative Models

- Introduction to Generative models
- Autoregressive and invertible models
- Latent variable models
- Variational inference and recognition networks (VAE, WAE),
- Adversarial Learning
- Generative Adversarial networks and variants (BiGAN, CycleGAN, StyleGAN, WGAN),
- Normalizing Flows
- Score/Diffusion based models

Block -4: Applications and Ethical Issues

Unit -10: Transfer Learning and Fine-Tuning

- Introduction to Transfer Learning
- Pre-Trained Models and Feature Extraction
- Fine-Tuning Deep Learning Models
- Strategies for Fine-Tuning
- Domain Adaptation in Transfer Learning
- Evaluation and Performance Metrics

Unit -11: Applications of Deep Learning

- Computer Vision
- Natural Language Processing (NLP)
- Speech Recognition and Synthesis
- Healthcare
- Autonomous Vehicles
- Finance
- Gaming
- Recommendation Systems
- Manufacturing and Industry
- Social Media and Marketing
- Environmental Monitoring
- Education

Unit -12: Ethical and Societal Implications

- Bias and Fairness
    - Understanding Bias in Machine Learning
    - Sources of Bias in Deep Learning Models
    - Fairness in Algorithmic Decision Making
    - Mitigating Bias and Promoting Fairness in Deep Learning Models
- Privacy Concerns and Data Ethics
    - Data Privacy in Deep Learning Systems
    - Ethical Collection and Use of Data
    - Privacy-Preserving Techniques in Deep Learning
    - Regulatory Compliance and Data Governance
- Responsible AI Practices
    - Ethical Design and Development of AI Systems
    - Transparency and Explainability in Deep Learning Models
    - Accountability and Liability in AI Systems
    - Responsible Deployment and Use of AI Technologies
- Societal Impacts of Deep Learning Technologies
    - Socio-Economic Implications of Automation
    - Job Displacement and Workforce Reskilling
    - Socio-Cultural Changes due to AI Adoption
    - Inequality and Accessibility in AI Technologies
- Ethical Considerations in Specific Applications
    - Healthcare: Patient Privacy and Medical Ethics
    - Criminal Justice: Fairness and Bias in Predictive Policing
    - Finance: Algorithmic Trading and Market Manipulation
    - Social Media: Filter Bubbles and Polarization
- Human-Centered Design and Human-AI Collaboration
    - Designing AI Systems with Human Values in Mind
    - Human-AI Interaction and Collaboration
    - Empowering Users with Control and Transparency
- Education and Awareness
    - Ethical Education for AI Practitioners
    - Public Awareness and Discourse on AI Ethics
    - Ethical Guidelines and Frameworks for Deep Learning Research and Practice

References:

1. Deep Learning, Ian Goodfellow, YoshuaBengio, Aaron Courville, MIT press, 2016.
2. Neural Networks and Deep Learning, Charu C. Aggarwal, Springer, 2018.
3. Learning deep architectures for AI-Foundations and trends in Machine Learning 2.1, Bengio, Yoshua, Now Publishers, 2009.
4. Deep Learning, Rajiv Chopra, Khanna Book Publishing, Delhi 2020.
5. Deep Learning with Python by Francois Chollet, Manning Publications, December 2017.
6. Fundamentals of Deep Learning: Designing Next-Generation Machine Intelligence Algorithms (1st. ed.). Nikhil Buduma and Nicholas Locascio. 2017.

O'Reilly Media, Inc.
7. Deep Learning: Methods and Applications, Deng & Yu, Now Publishers, 2013.
8. Satish Kumar, Neural Networks: A classroom Approach, TMGH, 2004.
9. Artificial Neural Networks, Yegnanarayana B, PHI Learning, 2006.

2. MCS – 230: Digital Image Processing and Computer Vision

Credits – 4

Block -1: Digital Images Processing-I

Unit -1: Introduction to digital image

1.0 Introduction
1.1 Objectives
1.2 Introduction to an image
1.3 Image Acquisition
1.4 Digitization of Images
1.5 Representation of Digital Image
1.6 Types of Image
1.7 Image Characteristics
1.8 Image Resolution
1.9 Areas of Applications of Digital Images
1.10 Summary
1.11 Solutions/Answers

Unit-2: Image Transformation

2.0 Introduction
2.1 Objectives
2.2 Signals
2.3 Image as a 2-D signal
2.4 Transformations of 2-D signal
2.5 Orthogonal Transformations of 2-D Signal
2.6 Unitary Transformations of 2-D signal
2.7 Fundamental Properties of Unitary Transformations
2.8 Summary
2.9 Solutions/Answers

Unit -3: Image enhancement in spatial domain

3.0 Introduction
3.1 Objectives
3.2 Image Enhancement
3.3 Point Operations
3.4 Contrast Stretching
3.5 Clipping and Thresholding
3.6 Digital Negative
3.7 Intensity Levels Slicing
3.8 Bit Extraction
3.9 Summary
3.10 Solutions/Answers

Unit -4: Image Filtering Operations in spatial domain

6.0 Introduction
6.1 Objectives
6.2 Spatial Filtering
6.3 Image Smoothing
Linear Filters
Non-Linear Filters
6.4 Image Sharpening
First Order Filters
Second Order Filters
6.5 Histogram Processing
6.6 Histogram Equalization
6.7 Histogram Specification
6.8 Summary
6.9 Solutions/Answers

Block -2: Digital Images Processing- II

Unit -5: Transformation Techniques

5.0 Introduction
5.1 Objectives
5.2 Discrete Fourier Transform
5.3 Discrete Cosine Transform
5.4 Discrete Wavelet Transform
5.5 Haar Transform
5.6 Summary
5.7 Solutions/Answers

Unit -6: Image enhancement and Filtering in Frequency Domain

6.0 Introduction
6.1 Objectives
6.2 Shifting the Centre of the Spectrum
6.3 Image Smoothing in Frequency Domain
6.4 Image Sharpening in Frequency Domain
6.5 Image Degradation
6.6 Image Degradation/Restoration Model
6.7 Noise Models
6.8 Restoration in the Presence of Noise Only-Spatial Filtering

3. MCS – 077: Natural Language Processing
Credits – 4

Block -1: Basics of NLP

Unit-1 : From Text to Tech: The Magic Behind NLP

1.0 Introduction
1.1 Objectives
1.2 Brief History
1.3 Language and Linguistics
1.4 Indian Linguistic Diversity
1.5 Significance of Natural Language Processing
1.6 Major Tasks in NLP
1.7 Role of Knowledge in Natural Language Processing
1.8 Levels of Natural Language Processing
- Phonological Level
- Morphological Level
- Syntactic Level
- Semantic Level
- Pragmatic Level
- Discourse Level
- Interplay of Level in NLP systems

1.9 Evaluation of Natural Language Processing Systems
- Importance of Evaluation in NLP
- Evaluation Metrics in NLP
- Evaluation Methodologies
- Human Evaluation
- Synthesis and Future Directions

1.10 Some Early NLP Systems
- ELIZA (1964–1966)
- SHRDLU (1970s)
- The ALPAC Report (1966)
- ELIZA's Successor: PARRY (1972)
- The LUNAR System (1970s)
- Syntax-Based Systems in the 1980s
- Early Machine Translation Systems

1.11 Programming Languages Used for Natural Language processing
1.12 Summary
1.13 Solutions/Answers

Unit-2 : Linguistics Essentials- 1

2.0 Introduction
2.1 Objectives
2.2 An Introduction to Linguistics and Indian Languages
- The science of languages
- Language and Script
- Descriptive and Prescriptive
- Language Families in India
- Areal and Typological Diversity

2.3 Parts of Speech and Morphology
- Noun pronouns
- Words that accompany nouns: determiners and adjectives
- Verb
- Other parts of speech
- Words and Word Forms
- Morphology fundamentals
- Morphology Paradigms

2.4 Summary
2.5 Solutions/Answers
2.6 References

Unit-3 : Linguistics Essentials -2

3.1 Syntax
- Generative Syntax from Phrase Structure to Minimalism
- Dependency: Arguments and adjuncts

3.2 Semantics and Pragmatics
- Lexical Semantics and Lexical Relationships
- Speech Acts
- Conversational Maxims and Implicature
- Linguistic Politeness

Unit-4 : Corpus-Based Work

4.1 Getting Set Up
- Computers
- Corpora
- Software

4.2 Collecting and Building Corpus
- Different kinds of corpora
- Methods of collecting corpora

4.3 Looking at Text
- Low-level formatting issues
- Tokenization: What is a word?
- Stemming and Lemmatization

4.4 Marked-up Data
- Markup schemes
- Grammatical tagging

Unit-5 : Language Models

5.0 Introduction
5.1 Objectives
5.2 Introduction to N-Gram Language Models
5.3 Basic Smoothing
5.4 Advanced smoothing for Language Modeling,
5.5 Evaluation of Language Models
5.6 Answer to Check Your Progress
5.7 References

Unit-6 : Large Language Models

6.0 Introduction
6.1 Objective
6.2 Statistical Language Models (SLM)
6.3 Neural Language Models (NLM)
6.4 Large Language Models (LLM)
- Autoregressive (AR) Models
- Auto-encoding Models
- Encoder-Decoder Models
- Sparse Models

6.5 LLM Architecture and How it works
6.6 Transformer based Architecture
6.7 How LLM How Large Language Models (LLM) work
6.8 Major LLMs and their characteristics
6.9 Prompting and Instruction tuning
6.10 Prompting
- Zero-shot prompting
- One-shot prompting
- Few-shot prompting
- Chain-of-thought (CoT) prompting

6.11 Instruction Tuning
6.12 Beyond Instruction Tuning: RLHF (Reinforcement Learning from Human Feedback)
6.13 Applications of LLM
6.14 Spelling and Grammar Correction:
6.15 Content Generation:
6.16 Translation:
6.17 Other Applications of LLM Translation:
6.18 Summary
6.19 Solutions/Answers
6.20 Bibliography

Block -2: Statistical Inference and Grammer

Unit- 7 : Statistical Inference: n-gram Models over Sparse Data

7.0 Introduction
7.1 Objective
7.2 Bins: Forming Equivalence Classes
7.3 Statistical Estimators
7.4 Combining Estimators
7.5 Answer to check your progress
7.6 References

Unit-8 : Sequence Labelling

8.0 Introduction
8.1 Objective
8.2 Introduction to Sequence Labelling
8.3 POS Tagging and Named Entity Recognition
8.4 Markov Model Taggers
- The probabilistic model
- The Viterbi algorithm
- Variations

8.5 Hidden Markov Model taggers
- Applying HMMs to POS tagging
- The effect of initialization on HMM training

8.6 Transformation-Based Learning of Tags
- Transformations
- The learning algorithm
- Relation to other models
- Automata

8.7 Other Methods, Other Languages
- Other approaches to tagging
- Languages other than English
- Maximum Entropy Models;
- Random Fields

8.8 Tagging Accuracy and Uses of Taggers
- Tagging accuracy
- Applications of tagging

8.9 Answer to Check Your Progress
8.10 References

Unit-9: Morphological Processing

9.0 Introduction
9.1 Objective
9.2 Morphological Analysers
- Types of Morphological Analyzers
- Working of Morphological Analyzers
- Examples of Morphological Analyzers

9.3 Morphological Analysis
- Finite State Machine Based Morphology
- Automatic Morphology Learning
- Introduction to Shallow Parsing

9.4 Evaluation of Morphological Analysers
9.5 Morphological Paradigm Generation
- Introduction
- Concept of Morphological Paradigm
- Importance of Morphological Paradigm Generation in NLP
- Approaches to Morphological Paradigm Generation
- Challenges in Morphological Paradigm Generation

9.6 Summary
9.7 Solutions to check your progress
9.8 References

Block -3: Basics of Parsing

Unit-10 : Probabilistic Context Free Grammars and Parsing

10.1 Some Features of PCFGs
10.2 Questions for PCFGs
10.3 The Probability of a String
- Using inside probabilities
- Using outside probabilities

- Finding the most likely parse for a sentence
- Training a PCFG

10.4 Probabilistic parsing : Introduction
- Sequence labeling,

10.5 Probabilistic parsing : Training issues
10.6 Arguments and Adjuncts
10.7 Problems with the Inside-Outside Algorithm

Unit-11 : Syntax-Constituency Parsing

11.1 Theories of Parsing,
- Syntax-Introduction
- Syntactic parsing

11.2 Parsing Algorithms.
- CYK (Cocke–Younger–Kasami) Algorithm,
- Evidence for deeper structure: Top-Down Parsing Algorithms
- Noun structure, Top-down parsing Algorithms
- Non-noun structure and parsing Algorithms

11.3 Robust and Scalable Parsing on Noisy Text as in Web documents.
11.4 Hybrid, Rule Based and Probabilistic Parsing
11.5 Scope Ambiguity and Attachment Ambiguity resolution.

Unit -12 : Dependency Parsing Basics

12.1 Dependency Grammar and parsing - Introduction
12.2 Transition Based Parsing : Formulation
12.3 Transition based Parsing: Learning
12.4 MST- based Dependency Parsing
12.5 MST- based Dependency Parsing : Learning

Block -4: Applications and Techniques

Unit 13: Information Retrieval and Question Answering

13.0 Introduction
13.1 Objective
13.3Introduction to Information Retrieval and Question Answering
13.4 Understanding Information Retrieval
13.5 Information Retrieval vs. Information Extraction
13.6 Workflow of an Information Retrieval System
13.7 Models of Information Retrieval
- Boolean Model
- Vector Space Model (VSM)
- Probabilistic Models
- Neural IR Models

13.8 Applications of Information Retrieval
13.9 Challenges in Modern IR
13.10 Question Answering Systems
13.10.1 IR-Based Question Answering
- Question Processing
- Query formulation
- Answer Type Determination
- Document and Passage Retrieval
- Answer Extraction
  - Feature-Based Answer Extraction
  - Neural Answer Extraction
  - BERT-Based Question Answering
  - BERT-Based Question Answering

13.10.2 Knowledge-Based Question Answering (KBQA)
- Rule-Based Methods
- Supervised Learning Methods
- Semi-Supervised and Weakly Supervised Methods

13.11 Generative Question Answering
13.12 Datasets for QA Systems
13.13 Evaluation of IR and QA Systems
13.14 Exercise

Unit -14 : Machine Translation

14.0 Introduction
14.1 Objectives
14.2 Rule-Based Machine Translation
14.3 Statistical Machine Translation
14.4 Cooperative NLP: Pivot-Based Machine Translation
14.5 Neural Machine Translation and Transformers
14.6 Evaluation of Machine Translation
14.7 Answers to Check Your Progress
14.8 References
14.9 Summary
14.10 Key terms
14.11 Further Reading
14.12 Exercises

Unit-15: Sentiment Analysis

15.0 Introduction
15.1 Objective
15.2 Problem Statement
15.3 Ambiguity for Sentiment Analysis
15.4 Lexicons for Sentiment Analysis
15.5 Rule-Based Sentiment Analysis
15.6 Statistical Sentiment Analysis
15.7 Neural Approaches to Sentiment Analysis
15.8 Sentiment Analysis in Different Languages
15.9 Answer to Check Your Progress
15.10 References

References:

1. Foundations of Statistical Natural Language Processing, Chris Manning and and Hinrich Schütze, MIT Press
2. Natural Language Processing, Pushpak Bhattacharya and Aditya Joshi, Wiley Press
3. Speech and Language Processing (3rd ed), Dan Jurafsky and James Martin. https://web.stanford.edu/~jurafsky/slp3/

4. MCS – 227: Cloud Computing & IoT
Credits – 4

Block -1: Cloud Computing Fundamentals and Virtualization

Unit -1: Cloud Computing- An Introduction

- 1.0 Introduction
- 1.1 Objectives
- 1.2 Traditional Computing
- 1.3 History and Evolution of Cloud Computing
- 1.4 Cluster Vs Grid Vs Cloud Computing
- 1.5 Characteristics of Cloud Computing
- 1.6 Benefits of Cloud Computing
- 1.7 Cloud Computing Applications
- 1.8 Challenges of Cloud Computing
- 1.9 Summary
- 1.10 Solutions/Answers
- 1.11 Further Readings

Unit -2: Cloud Deployment Models, Service Models and Cloud Architecture

- 2.0 Introduction
- 2.1 Objectives
- 2.2 Cloud Deployment Models
  - 2.2.1 Public Cloud
  - 2.2.2 Private Cloud
  - 2.2.3 Community Cloud
  - 2.2.4 Hybrid Cloud
- 2.3 Choosing Appropriate Deployment Model
  - 2.3.1 Suitability of Public Cloud
  - 2.3.2 Suitability of Private Cloud
  - 2.3.3 Suitability of Community Cloud
  - 2.3.4 Suitability of Hybrid Cloud
  - 2.3.5 Comparative Analysis of Cloud Deployment Models
- 2.4 Service Delivery Models
  - 2.4.1 Infrastructures As a Service (IaaS)
  - 2.4.2 Platform As a Service (PaaS)
  - 2.4.3 Software As a Service (SaaS)
  - 2.4.4 Other Services (Security Management, Identity Management, Storage, Database, Back-up, etc.)
- 2.5 Cloud Architecture
- 2.6 Layers and Anatomy of the Cloud
- 2.7 Network Connectivity in Cloud Computing
- 2.8 Summary
- 2.9 Solutions/Answers
- 2.10 Further Readings

Unit -3: Resource Virtualization

- 3.0 Introduction
- 3.1 Objectives
- 3.2 Virtualization and Underlying Abstraction
- 3.3 Characteristic Features of Virtualization
  - 3.3.1 Advancement in Security
  - 3.3.2 Managing of Execution
- 3.4 Advantages of Virtualization
- 3.5 Machine or Server Level Virtualization
- 3.6 Hypervisor
- 3.7 Full Virtualization
- 3.8 Para-Virtualization
- 3.9 Other Virtualization Techniques
  - 3.9.1 Network Virtualization
  - 3.9.2 Storage Virtualization
  - 3.9.3 Desktop Virtualization
  - 3.9.4 Operating System Virtualization
  - 3.9.5 Data Virtualization
  - 3.9.6 Application Virtualization
- 3.10 VMware Vs XenServer
- 3.11 Summary
- 3.12 Solutions/Answers

11.4 Cloud Computing Vs Fog Computing
11.5 Fog Computing Architecture
11.6 Working of Fog Computing
11.7 Advantages of Fog Computing
11.8 Application of Fog Computing
11.9 Challenges in Fog Computing
11.10 Edge Computing
11.11 Edge Computing Architecture
11.12 Cloud-Fog-Edge Architecture
11.13 Cloud Vs Fog Vs Edge
11.14 Applications of Edge Computing
11.15 Summary
11.16 Solutions/Answers
11.17 Further Readings

Unit -12: IoT Case Studies

12.0 Introduction
12.1 Objectives
12.2 IoT Use Cases for Smart Cities
12.3 Smart Homes
12.4 Applications of IoT in Agriculture
12.5 Smart Transportation
12.6 Smart Grids
12.6.1 Key Features of Smart Grid
12.6.2 Benefits of Smart Grid
12.7 Connected Vehicles
12.7.1 Connected Cars
12.7.2 How does Connected Car Technology Work?
12.7.3 Features of Connected Cars
12.7.4 Types of Connectivity
12.8 Smart Healthcare
12.9 Industrial IoT (IIoT)
12.9.1 Industry 4.0 and IoT
12.9.2 IIoT Architecture
12.9.3 Applications of IoT
12.9.4 IIoT Use Cases
12.10 Summary
12.11 Solutions/Answers
12.12 Further Readings

5. MCSL – 076: Deep Learning Lab

Credits – 2

Objectives:

Main objective of this laboratory course is to provide hands on exercises to the learners based on Deep Learning course.

Lab Sessions:

- There will be 20 practical sessions (3 hours each).
- The practice problems for all 20 sessions will be listed session-wise in the lab manual.
-

6. MCSL – 088: Digital Image Processing and Computer Vision Lab

Credits – 2

Objectives:

Main objective of this laboratory course is to provide hands on exercises to the learners based on Digital Image Processing and Computer Vision course.

Lab Sessions:

- There will be 20 practical sessions (3 hours each).
- The practice problems for all 20 sessions will be listed session-wise in the lab manual.

SEMESTER – IV

1. MCS – 073: Soft Computing

Credits – 4

Block -1: Introduction to Soft Computing and Fuzzy Logic

Unit -1: Introduction to Soft Computing

- Concept of computing systems.
- "Soft" computing versus "Hard" computing
- Characteristics of Soft computing
- Some applications of Soft computing techniques

Unit -2: Fuzzy Set theory

- Introduction to Fuzzy logic.
- Fuzzy Sets & Classical Sets;
- Operations on Fuzzy Sets, Fuzzy Relations, Linguistic Variables.

Unit -3: Membership Functions

- Introduction,
- Features & Fuzzification,
- Methods of Membership Value Assignment;
- Defuzzification.

Unit -4: Fuzzy Systems:

- Crisp Logic, Predicate Logic, Fuzzy Logic;
- Fuzzy Rule Base and Approximate Reasoning, Fuzzy Quantifiers;
- Fuzzy Inference Systems, Fuzzy Decision Making, Fuzzy Logic Control System; Fuzzy Expert Systems.
- Some applications of Fuzzy logic

Block -2: ANN

Unit -5: Artificial Neural Networks

- Fundamental Concepts, Basic Models and Architecture;
- Machine Learning Using Neural Networks;
- Activation functions
- Associative Memory Networks and their Applications.

Unit -6: Supervised and unsupervised learning Networks:

- Perceptron Networks,
- Radial Basis Function Networks:
- Back Propagation Neural Network: Architecture, Learning, Applications, & Research Directions;
- Competitive Learning networks;
- Kohonen Self-Organizing Networks;
- Hebbian learning; The Hopfield Network;

Block -3: Genetic Algorithm

Unit -7: Genetic Algorithms: concepts, framework and architectures

- Introduction to Genetic Algorithms (GA) and their Terminology;
- Traditional Optimization and Search Techniques vs Genetic Algorithm;
- Basic GA framework and different GA architectures.

Unit -8: GA operators and problem solving with GA

- Operators in Genetic Algorithms;
- Problem Solving using Genetic Algorithm;
- Classification of Genetic Algorithms; Holland's Classifier Systems;

Unit -9: Genetic Programming and applications of GA

- Genetic Programming;
- Advantages and Limitations of Genetic Algorithm;
- Applications of Genetic Algorithm;
- Applications of GA in Machine Learning.

Block 4:

Unit -10: Multi-objective Optimization Problem Solving

- Concept of multi-objective optimization problems (MOOPs) and issues of solving them.
- Multi-Objective Evolutionary Algorithm (MOEA).
- Non-Pareto approaches to solve MOOPs
- Pareto-based approaches to solve MOOPs
- Some applications with MOEAs.

Unit -11: Swarm Intelligence

- Particle Swarm Optimization
- Ant Colony Optimization
- Honeybee mating Optimization
- Firefly Algorithm
- Shuffled frog leaping algorithm

Unit -12: Applications of Soft Computing

- Applications of Fuzzy logic to solve some real-life problems
- Applications of ANNs to solve some real-life problems
- Applications of GA to solve some real-life problems

Text and Reference books:

1. Soft Computing, D. K. Pratihar, Narosa, 2008.

2. Fuzzy Logic: A Pratical approach, F. Martin, , Mc neill, and Ellen Thro, AP Professional, 2000.
3. Fuzzy Logic with Engineering Applications (3rd Edn.), Timothy J. Ross, Willey, 2010.
4. Foundations of Neural Networks, Fuzzy Systems, and Knowldge Engineering, Nikola K. Kasabov, MIT Press, 1998.
5. Neural Networks, Fuzzy Logis and Genetic Algorithms : Synthesis, and Applications, S. Rajasekaran, and G. A. Vijayalakshmi Pai, Prentice Hall of India, 2007.
6. Neural Networks and Learning Machines, (3rd Edn.), Simon Haykin, PHI Learning, 2011.
7. An Introduction to Genetic Algorithms, Melanie Mitchell, MIT Press, 2000.
8. Genetic Algorithms In Search, Optimization And Machine Learning, David E. Goldberg, Pearson Education, 2002.
9. Practical Genetic Algorithms, Randy L. Haupt and sue Ellen Haupt, John Willey & Sons, 2002.

2. MCS – 089: Reinforcement Learning

Credits – 4

Block -1: Basics of Reinforcement Learning

Unit -1: Introduction to Reinforcement Learning

- What is Reinforcement Learning?
- A Brief History
- Examples of Reinforcement Learning
- Comparison of Reinforcement learning with Supervised and Unsupervised Learning
- Reinforcement learning elements
- Limitations of Reinforcement Learning

Unit -2: Markov Decision Processes

- What are Markov Decision Processes?
- Example of MDP
- Meaning of terms of MDP: Rewards, Discount, Actions etc.
- MDP vs Deterministic Search
- The Markov Property
- Policies
- Bellman Equation and optimality

Unit -3: Multi-arm Bandits Problem

- Definition of n-Armed Bandit Problem
- Exploration and Exploitation
- Example of a multi-arm Bandit problem
- Explanation of Action-Value Methods
- Incremental Implementation

Block -2: Solution Methods for Reinforcement Learning

Unit -4: Dynamic Programming for Reinforcement Learning

- Policy Evaluation
- Policy Improvement
- Policy Iteration
- Value Iteration
- Asynchronous Dynamic Programming

Unit -5: Monte Carlo Methods and Reinforcement Learning

- Monte Carlo Prediction
- Monte Carlo Estimation of Action Values
- Monte Carlo Control with or without states
- Off-policy Prediction via Importance Sampling
- Example

Unit -6: Temporal-Difference Learning

- Temporal - Difference Prediction
- Advantages of Temporal–Difference Prediction Methods
- Optimality of Temporal Difference
- Example On-Policy TD

Block -3: Deep Reinforcement Learning

Unit -7: Deep Q Learning

- What is Tabular Q Learning?
- What is Deep Q Learning
- Examples
- Key concepts in deep Q Networks
- Algorithm or technique of DQN

Unit -8: Policy Based Methods for Deep Reinforcement Learning

- Why Policy-Based Methods?
- Continuous action spaces
- Stochastic policies
- Examples
- Introduction to Policy Gradient Concepts
- Example

Unit -9: Model-based Methods for Deep Reinforcement Learning

Need of Model based methods.

Optimal control Problem
Random Shooting

Covariance matrix adaptation

Block -4: Applications of Reinforcement Learning

Unit -10: Use of Reinforcement Learning in Tic-Tac-Toe

Defining the Game

Python code for Reinforcement Learning of the game

Explanation of code

Advantage of using Reinforcement learning in the game

Unit -11: Learning by a Robot

Issues

Python Library that can be used

Strategy for Robot Learning

Unit -12: Current Applications

Marketing.

Finance

Smart City

Language Models

References:

1. "Reinforcement Learning: An Introduction" Second Edition, Richard S. Sutton and Andrew G. Barto, The MIT Press Cambridge, Massachusetts London, England 2018.
2. "Mastering Reinforcement Learning with Python", Enes Bilgin, Packt Publishing, 2020.

MCSP-090: Project Work

Credits-12

This course provides learners with an opportunity to apply theoretical knowledge of Artificial Intelligence and Machine Learning to real-world problems. The project emphasizes problem formulation, data handling, model development, evaluation, and documentation following research and ethical standards. The project may be industry-based, research-oriented, application-based, or socially relevant AI solution development.

The objective(s) of Project:

After completing the project, the learner will be able to:

1. Identify and define a real-world AI/ML problem.
2. Conduct a structured literature survey.
3. Collect, preprocess, and analyze datasets.
4. Apply suitable Machine Learning / Deep Learning algorithms.
5. Evaluate model performance using appropriate metrics.
6. Interpret results and suggest improvements.
7. Prepare a professional technical report.
8. Present and defend the project during viva voce.

Students may select topics from (but not limited to):

Machine Learning: Supervised Learning (Regression, Classification), Unsupervised Learning (Clustering, Dimensionality Reduction), Reinforcement Learning; **Deep Learning:** CNN for Image Classification, RNN/LSTM for Time Series Forecasting, Transformer-based NLP models; **Natural Language Processing:** Sentiment Analysis, Chatbot Development, Text Classification; **Computer Vision:** Object Detection, Face Recognition, Medical Image Analysis; **Data Science & Analytics:** Predictive Analytics, Recommendation Systems, Fraud Detection; **Emerging Areas:** Generative AI, Explainable AI (XAI), AI for Healthcare, AI for Agriculture, AI for Education, AI Ethics & Responsible AI.

Learners are encouraged to dedicate efforts equivalent to 12 credits towards a project, preferably in a software industry or research organization specializing in Artificial

Intelligence and Machine Learning. The selected topics should be sufficiently complex and substantial to qualify as a M.Sc. Artificial Intelligence and Machine Learning project. The coursework completed during the M.Sc. program equips learners with a comprehensive background to work across diverse Artificial Intelligence and machine learning domains. Strict adherence to project guidelines is expected, which will be provided and made available on the university's website.

4 EVALUATION SCHEME

Completion of the programme requires successful completion of both assignment component and the Term-end Examination component for each course in the programme. The total number of courses in this MSCAIML programme are 21 (including a Project course) of 80 credits in total.

Evaluation of each course of MSCAIML programme (except project course) consists of two components:

a) Continuous evaluation through Assignment with a weightage of 30% which includes compulsory viva-voce (please refer to the Table in section 4.0).
b) Term-end examination with a weightage of 70% (please refer to the Table in section 4.0).

Note: ***A learner should not apply for appearing in the term-end examination of any course without getting registered for the same and that if s/he does so, her/his result would not be declared and the onus shall be on her/him.***

Award of Final Division:

The final score of a student is computed as follows:

- The marks obtained in a 4-credit course are computed out of maximum of 100
- The marks obtained in a 2-credit course are computed out of maximum of 50
- The marks obtained in the Project course are computed out of maximum of 200
- The marks of all the semesters are added. These marks are out of maximum of 1900 marks.

The final division of a student is awarded as follows:

Marks Range	**Division**
75% and above	First Division with Distinction
60% or more but less than 75%	First Division
50% or more but less than 60%	Second Division
40% or more but less than 50%	Third Division

4.0 Assignments and Term – End Examination

The main purpose of assignments is to test student's comprehension of learning the materials they receive from the University and also to help them get through the courses by providing feedback to them. The information given in the course materials should be sufficient for answering the assignments. However, as Computer Science is an ever-enhancing area, the students should make an attempt and work with extra reading material, which is easily available at the Learner Support Centre / Regional Centre libraries or through websites, for working on the assignments. This will enhance your

learning capabilities. Mostly the assignments are designed in such a way as to help you concentrate mainly on the course material, exploit their personal experiences and apply the knowledge gained from various sources.

Assignments

There will be **one comprehensive assignment for each course of 100 marks (weightage of 30%)**. The assignments for each semester are uploaded on the IGNOU's website.

All the assignments and term-end exams will be scored on a **numerical marking scheme.** Any component that has not been attempted would be treated as having a score of zero marks. The requirement for passing would be at least **40% in continuous evaluation (assignment) and 40% in the term-end examination,** with an **overall average of 40% for a pass in the course.**

The viva voce is compulsory for the assignment evaluation. For any course, in case, if a student submitted the assignment but did not attend the viva-voce, then the assignment is treated as **not successfully completed** and would be marked as **ZERO.**

In order to be able to appear for the Term-end examination, it is a requirement that the student submit all the assignments according to the prescribed schedule. All students will be required to give an undertaking to this effect, and should it be later found that they had in fact not submitted the assignments as prescribed; the results for the Term-end examination will be treated as cancelled.

Viva-voce is compulsory for all the Assignments.

Unfair means in attempting the assignments

If the learners copy the assignments, which is an important component of the ODL system, such assignments will be awarded "zero" and such students will be directed to re-attempt the fresh assignments pertaining to the next year which will indirectly delay the award of degree by a semester/ year.

Additional guidelines for Lab Course assignments and TEE

A student MUST maintain lab records of all the practical sessions attended by him/her. This lab record has weightage in continuous evaluation of lab courses. The following are the evaluation guidelines for the lab courses.

(i) Evaluation of the assignments of lab courses

Evaluation of the assignment of each lab course consists of the following:

- Practical sessions - lab records (40 marks)
- Assignment questions (40 marks)
- Viva-voce **(**20 marks)

The marks allotment for assignments of the lab courses are shown in the following table:

Course name	**Course code**	**Lab records (40)**	**Assignment questions (40)**	**Viva-Voce (20)**	**Total marks (100)**

Data Structures and Algorithms Lab	MCSL-209	Part–1(40)	Part–1(40)	20	100
Programming and AI Lab	MCSL-083	Part–1(20) Part–2(20)	Part–1(20) Part–2(20)	20	100
Machine Learning and Pattern Recognition Lab	MCSL-086	Part–1(20) Part–2(20)	Part–1(20) Part–2(20)	20	100
Database Management Systems Lab	MCSL-087	Part–1(40)	Part–1(40)	20	100
Deep Learning Lab	MCSL-076	Part–1(40)	Part–1(40)	20	100
Digital Image Processing and Computer Vision Lab	MCSL-088	Part–1(40)	Part–1(40)	20	100

Note: Minimum passing marks in each lab assignment (lab records + Assignment questions + viva-voce) is **40%.**

Evaluation Scheme

The table shown below provides the detailed marking scheme for the MSCAIML courses:

Seme-ster	**Course Code**	**Course Title**	Credits	**Continuous Evaluation** **Assignment (Weightage –** 30**%)**		**Term End Examination** **Theory or Practicals*** **(Weightage –** 70**%)**		
				Max Marks	**Min. Marks**	**Duration**	**Max. Marks**	**Min. Marks**
I	MCS-061	Mathematical Foundations - I	4	100	40	3	100	40
	MCS-208	Data Structures and Algorithms	4	100	40	3	100	40
	MCS-081	Artificial Intelligence	4	100	40	3	100	40
	MCS-082	Programming Using Python	4	100	40	3	100	40
	MCSL-209	Data Structures and Algorithms Lab	2	100	40	2	50	20
	MCS-083	Programming & AI Lab	2	100	40	2	50	20
II	MCS-066	Mathematical Foundations –II	4	100	40	3	100	40
	MCS-084	Machine Learning	4	100	40	3	100	40
	MCS-	Pattern Recognition	4	100	40	3	100	40

	085							
	MCS-207	Database Management Systems	4	100	40	3	100	40
	MCSL-086	Machine Learning and Pattern Recognition Lab	2	100	40	2	50	20
	MCSL-087	Database Management Systems Lab	2	100	40	2	50	20
III	MCS-072	Deep Learning	4	100	40	3	100	40
	MCS-230	Digital Image Processing and Computer Vision	4	100	40	3	100	40
	MCS-077	Natural Language Processing	4	100	40	3	100	40
	MCS-227	Cloud Computing & IOT	4	100	40	3	100	40
	MCSL-076	Deep Learning Lab	2	100	40	2	50	20
	MCSL-088	Digital Image Processing and Computer Vision Lab	2	100	40	2	50	20
IV	MCS-073	Soft Computing	4	100	40	3	100	40
	MCS-089	Reinforcement Learning	4	100	40	3	100	40
	MCSP-090	Project Work**	12	Report – 150 (Min. 60) and Viva 50 (Min. 20)				

* Practical examination will be conducted for the lab courses only. The letter 'L' in the course code represents the lab course. Pass in each and every part in the practical course of Term-End Practical Examination is compulsory in order to get it declared successful in the respective course.

** The Project consist of 2 components namely project report evaluation and viva-voce. Viva-voce is compulsory and forms part of evaluation. A student in order to be declared successful in the project must secure 40% marks in each component (i)Project Evaluation and (ii)Viva-voce.

** Students are required to submit the MCSP-090 Project Proposal (Synopsis) during the third semester through their respective Regional Centre (RC) or Learner Support Centre (LSC) to ensure timely approval. This will allow learners adequate time to work on the project and submit the Project Report in the fourth semester, thereby enabling them to complete the programme within the minimum prescribed duration.

Note: If a learner decides to EXIT from the programme after successful completion of all the courses of first two semesters (40 credits), then the learner is eligible for the award of Post Graduate Diploma in Artificial Intelligence and Machine Learning. However, to mention that there is no explicit admission for Post Graduate Diploma in Artificial Intelligence and Machine Learning.

Evaluation of Term-End Practical Examinations for Lab Courses

The term-end examination of the practical courses consists of several sections. Each section will be evaluated separately. The viva-voce for each section will also be separate. The following table shows the details:

(Practical questions –80 % and Viva-voce – 20 %)

Course name	**Course Code**	**Duration of TEPE (Each section gets Equal time)**	**Marks for Term-end practical examination and viva-voce**	
			Section-1	**Section-2**
Data Structures and Algorithms Lab	MCSL-209 (2 Credits)	2 hours	40(P) + 10 (V) = 50 marks	#
Programming & AI Lab	MCSL-083 (2 Credits)	2 hours	20(P) + 5(V) = 25 marks	20(P) + 5(V) = 25 marks
Machine Learning and Pattern Recognition Lab	MCSL-086 (2 Credits)	2 hours	20(P) + 5(V) = 25 marks	20(P) + 5(V) = 25 marks
Database Management Systems Lab	MCSL-087 (2 Credits)	2 hours	40(P) + 10 (V) = 50 marks	#
Deep Learning Lab	MCSL-076 (2 Credits)	2 hours	40(P) + 10 (V) = 50 marks	#
Digital Image Processing and Computer Vision Lab	MCSL-088 (2 Credits)	2 hours	40(P) + 10 (V) = 50 marks	#

P- Problems given in the exam paper, V – Viva-voce for that section, # - Not Applicable.

A student needs to obtain a minimum of 40% in each section of the term-end practical examination for successful completion of that particular section. In case a student does not secure the minimum passing marks in a section, s/he needs to appear for the term-end practical examination again for that section only.

4.1 Instructions for Assignments

While answering Assignments, the following guidelines are required to be followed:

The word limits for answering most of the questions are mentioned with them. If no word limit is prescribed, then assume it to be about 300 words. You will find it useful to keep the following points in mind:

i) **Planning:** Read the assignment carefully. Go through the units on which they are based. Make some points regarding each question and rearrange these in logical order.

ii) **Organisation:** Be a little more selective and analytical before drawing up a rough outline of your answer. In an essay-type question give adequate attention to your introduction and conclusion. The introduction must offer brief interpretation of the question and how you propose to develop it. The conclusion must summarize your response to the question. Make sure that your answer:
   a) is logical and coherent;
   b) has clear connection between sentences and paragraphs;
   c) is written correctly giving adequate consideration to your expression, style and presentation;
   d) do not exceed the number of words indicated (if any) in your questions.

iii)**Presentation:** Once you are satisfied with your answers, you can write down the final version for submission, writing each answer neatly and underlining the points you want to emphasize.

The following format is to be followed for submission of the assignment:

1. The top of the first page of your response sheet for each assignment should look like this:

PROGRAMME TITLE:.....	ENROLMENT No. :.....
COURSE CODE:.....	NAME :.....
COURSE TITLE:.....	ADDRESS:.....
ASSIGNMENT CODE :.....	SIGNATURE :.....
LSC NAME AND CODE:.....	DATE : .....

2. Read instructions for submission of assignments given here. The assignments response sheets should be **HANDWRITTEN**. However, the software coding, snapshots, test cases, etc. can be in the printed form. Students should not reproduce their answers from the units sent to them by the University. If they reproduce from the units, they will get poor marks for the respective question**.**

3. The students should write each assignment separately. All the assignments should not be written in continuity.

4. The students should write the question number with each answer. Photocopy of the submitted assignment is to be retained by the student for his or her own record and future reference, if any.

5. The students should use only A4 size paper for their response and tag all the pages carefully. Avoid using very thin paper. They should allow a 4-cm. margin on the left and at least 4 lines in between each answer. This may facilitate the evaluator to write useful comments on the margins at appropriate places.

6. The students should not copy the assignments from others. If copying is noticed, the assignments of such students will be rejected, and disciplinary action will be taken against the students as per rules of the University.

7. The completed assignment response should be sent to the Coordinator of the Learner Support Centre. **Under no circumstances should they be sent to the SED Division or the School at Headquarters**, for evaluation. After submitting the assignment at the Learner Support Centre in person, the students should get the acknowledgement from the Coordinator on the prescribed assignment-cum-acknowledgement card; otherwise, the assignment response should be sent under certificate of posting through post. The students should get back evaluated assignments from their Learner Support Centres within one month of its submission for the feedback and for their future guidance.

8. In case the student has requested for a change of LSC, s/he should submit her/his assignments only to the original LSC until the University effects the change of LSC.

4.2 Guidelines Regarding the Submission of Assignments

1. It is compulsory for the students to submit all the prescribed assignments. They will not be allowed to appear for the term-end examination of a course if they do not submit the specified number of assignments in time for that course.

2. Students should download the latest assignment from the IGNOU website.

3. The assignment responses should be complete in all respects. Before submission, the students should ensure that they have answered all the questions in all assignments. Incomplete answer sheets bring poor grades.

4. The Coordinator of the LSC has the right to reject the assignments received after the due date. Therefore, the students are advised to submit their assignments before the due date.

5. Students should enclose a self-addressed stamped assignment remittance-cum- acknowledgement card with each assignment response to ensure the delivery of assignments before the last dates prescribed for submission of assignments.

6. In case any student fails to submit the assignments or fails to score minimum qualifying marks, s/he has to wait for fresh assignments meant for the current batch of students.

7. For their own record, students should retain a photocopy of all the assignment responses, which they submit to the Coordinator of their LSC. If they do not get back their duly evaluated assignment within a month after submission, they should try to get it from their LSC personally. This may help them to improve upon future assignments.

8. As per the University norms, once the student's scores pass marks in an assignment, they cannot re-submit it for improvement of marks.

9. Assignments are not subject to re-evaluation except for factual errors, if any. The discrepancy noticed by the students in the evaluated assignments should be brought to the notice of the Coordinator of the LSC, so that he forwards the correct score to the SED at the Headquarters.

10. The students should not enclose or express doubts for clarification, if any, along with the assignments. They should send their doubts in a separate cover to the Registrar, SED, Indira Gandhi National Open University, Maidan Garhi, New Delhi - 110 068. While doing so they should give their complete Enrolment number, name, address, programme code.

Note: Please submit your Assignments on or before the due date at your LSC.

11. In case of not successfully completed or missed; the assignments should be demanded only if your registration for that course is valid.

12. Assignments should not be demanded to improve your score if you have secured minimum qualifying score in a course.

13. Please do not submit your assignment responses twice either at the same LSC or at different LSC for evaluation.

14. There is no provision for reevaluation of Assignments, practical examination and project evaluation.

4.3 General Guidelines Regarding the Term-End Examination

1. To be eligible to appear the Term-end Examination in any course, the students are required to fulfil the following conditions:

    a) registration for the courses, in which they wish to appear is valid,

    b) they should have opted and pursued the prescribed courses

c) minimum time to pursue these courses is elapsed

d) they have also submitted the required number of assignment(s), if any.

e) they have submitted the online examination form of IGNOU and have paid the requisite examination fees.

2. The University conducts term-end examination twice a year, in June and December. The student can take the examination only after the minimum period prescribed for the course of study has elapsed.

3. Examination schedule indicating the date and time of examination which is available at IGNOU website https://www.ignou.ac.in for each session i.e. June/December.

4. The online examination form is to be filled up from IGNOU website about 2-3 months prior to examination. (You MUST visit IGNOU website for actual cutoff dates. The details of late fee are also displayed on the website.). You are required to pay examination fee per course at the time of filling up of the form. You can pay online using Credit Card / Debit Card /Net Banking while filling up the form. It may also be noted that in case, examination fee needs to be returned to student due to technical reasons, the fee will be refunded to the same account (Credit card/ Debit card/ Net Banking) from which the payment was made.

The link to online Examination form, in general, is put on the HOME page of IGNOU website.

YOU MUST READ and FOLLOW all the instructions very carefully. You can save these instructions for any future reference. These instructions relates to:

- Dates for the Submission of Online Term End Examination form
- Prerequisite for the submission of the Term End Examination Form
- Process to submit Term End Examination Form
- Examination fee and Mode of Payment
- Un-successful Submission of Exam Form
- Related to Refund excess Examination Fee
- Hall Ticket for Term End Examination
- Contact Details

Important Guidelines and instructions for submission of Term End Examination form and other forms (Please note that guidelines and fee for forms may change, therefore, you are advised to read guidelines and fee details as per latest forms available online or on the IGNOU website)

1. Please ensure that you have already submitted the assignments as applicable for the courses you are filling in the Examination Form. You are required to pay examination fee for every course of theory as well as practical.

2. Students are requested to check the result status before filling examination form.

3. Select and enter Programme code and Examination Centre Code from the options available. If the centre opted by the student is not activated as examination centre or not allotted for any other reason, alternative examination centre will be allotted.

4. Select courses carefully. Courses for theory as well as practical need to be selected separately from the list appearing on the screen.

5. Students will be allowed to appear in Term-end Examination for the course(s) for which registration is valid and not time-barred and assignment(s) is/are submitted. Examination Fee once submitted will not be refunded.

6. Students should carry their **Identity Card and Hall ticket** (download hall ticket from IGNOU website indicating Centre and Date of Examination) to the Examination Centre.

7. In case a student fails to receive the intimation slip/Hall ticket may please contact at SED (SE-II) branch. (https://www.ignou.ac.in/pages/182#ContactUs)

8. Students must carry IGNOU Identity-Card in the Examination Hall for writing Examination. In case, students do not have IGNOU Identity card due to various reasons, they must get it issued (i.e. duplicate copy of IGNOU Identity card) from Regional Centre concerned well before the start of the Examination. Students are required to contact the RC in person (by post) and get the duplicate Identity card for attending Examination.

9. The students will be entitled to appear for the examination only at the examination centre allotted to them and **NOT** at any other centre without specific permission from the University. The Examination Centre once opted for in a form shall not be changed.

10. Although all efforts will be made to declare the results in time, there will be no binding on the University to declare the results of the last examination before the commencement of next examination. The students may, therefore, fill up the examination form without necessarily waiting for the result and get it cancelled at a later date, if so desired. In case the student gets result after filling up the exam form, s/he should not re-appear in the course qualified by her/ him with a view to improve the qualified score.

11. Students who fail to complete the minimum required number of course(s) prescribed for the Programme within the allotted period of study shall cease to be on the rolls of this University for that programme till they re-enroll themselves, if they wish to do so. Such students are advised to get in touch with the Regional Director concerned.

12. **Obtaining Photocopy of Answer Scripts:** After the declaration of result, if the students are not satisfied with the marks awarded, they can request the University for Photocopy of Answer Scripts on payment of ₹100/- per course. The request for obtaining Photocopy of Answer Scripts by the student must be made within 30 days from the date of declaration of result to the Evaluation Centre concerned in the prescribed format along with the fee of ₹100/- per course in the form of Demand Draft in favour of IGNOU payable at the city where submitting the request for Photocopy. Format is available on the IGNOU website: https://www.ignou.ac.in/pages/280

13. **Re-evaluation of Answer-script(s):** The University has replaced the scheme of rechecking with the re-evaluation whereby the answer-scripts will be re-evaluated by another Evaluator in case the students are not satisfied with the marks/grades secured by them in Term-End Examination. Such students can apply for re-evaluation within one month from the date declaration i.e. the date on which the results are made available on the University Website on payment of ₹750/- per course in the prescribed application form available on the University Website. The better of the two courses of original marks/grades and re-evaluated marks/grades will be considered and the revised marks/grades shall be incorporated in the students' record as applicable and the revised grade card/marks sheet will be sent to the students within one month from the receipt of application. Re-evaluation is not permissible for Projects, Practical, Assignments and Seminars etc. (https://www.ignou.ac.in/pages/280)

5 OTHER USEFUL INFORMATION

5.0 Reservation of Seats

The University provides reservation of seats for Scheduled Castes, Scheduled Tribes and Physically Handicapped students as per the Government of India rules.

5.1 Scholarships and Reimbursement of Fee

Reserved Categories, viz., Scheduled Castes, Scheduled Tribes and Physically Handicapped students etc. have to pay the fee at the time of admission to the University along with other students. Physically Handicapped students admitted to IGNOU are eligible for Government of India scholarships. They are advised to collect scholarship forms from the respective State Government Directorate of Social Welfare or Office of the Social Welfare Officer and submit the filled-in forms to them **through the Regional Director of IGNOU concerned.**

Similarly, SC/ST students have to submit their scholarship forms to the respective State Directorate of Social Welfare or Office of the Social Welfare Officer, **through the Regional Director of IGNOU concerned for suitable reimbursement.**

5.2 Change/Correction of Address

There is a proforma for change/correction of address. This form duly filled in is to be submitted to the **Regional Director concerned**. Students are advised not to write letters to any other officer in the University in this regard. Normally, it takes 4-6 weeks to effect the change. Therefore, the students are advised to make their own arrangements to redirect the mail to the changed address during this period.

5.3 Change of Regional Centre and Learner Support Centre

Counselling facilities are not available for all the programmes at all the Learner Support Centres. As such, students are advised to make sure that counselling facilities are available, for the subject s/he has chosen, at the new centre opted for. Request for change of Learner Support Centre is acceded subject to availability of seats for the programme at the new centre asked for only on compelling grounds. Students are required to get a NOC from the Regional center where they are willing to get themselves transferred in view of the practical sessions involved in MSCAIML. When a student wants transfer from one region to another, s/he has to write to that effect to the Regional Centre from where s/he is seeking a transfer, marking copy to the Regional Centre where s/he would like to be transferred to and also to Registrar, Student Registration Division (SRD), IGNOU, Maidan Garhi, New Delhi-110068. Further, s/he has to obtain a certificate from the Coordinator of the Learner Support Centre from where s/he is seeking transfer from, regarding the number of assignments submitted. The Regional Director from where the student is seeking the transfer will transfer all records including details of fee payment to the Regional Centre where the student is going, under intimation to the Registrar, SRD and the student. The transfer will be permitted only if seats are available at the new Learner Support Centre.

5.4 Procurement of Official Transcripts

The University provides the facility of obtaining official transcripts on request, made by the learners in prescribed application form for official transcript, which provides details of fee, where to apply etc.

5.5 Duplicate Grade Card

The learner can apply for obtaining duplicate Grade Card in case the same has been lost/misplaced/damaged, by making a request in prescribed application form for Duplicate Grade card, which provides details of fees etc.

5.6 Self instructional Materials of Your Programme of Study

Self-instructional material will be available through eGyankosh, IGNOU eContent App and later the self-instructional materials may be dispatched to the student's registered address.

You should visit your Regional Centre (RC)/ Learner Support Centre (LSC) concerned with ID card for schedule of theory and practical counselling sessions.

5.7 Disputes on Admission and other University Matters

In case of any dispute, the place of jurisdiction for filing of a suit/plaint/petition will be only at New Delhi / Delhi.

6 SOME USEFUL ADDRESSES

For specific queries related to Admission, Study Material, Assignment, Examination, Counselling etc. the students may contact the following:

Sl. No.	Issues	Authority to be contacted
1	Identity Card, Fee Receipt, Bonafide Certificate, Migration, Certificate, Scholarship Forms, change of name, correction ofname/address	Concerned Regional Centre
2	Non-receipt of study material	Registrar (MPDD), IGNOU, Maidan Garhi, New Delhi-110068 mpdd@ignou.ac.in, Ph: 011-29572008, 29572012
3	Change of Elective/Medium/opting of left over electives/ Deletion of excess credits	Concerned Regional Centre
4	Credit Transfer	Student Registration Division, Block No. 1 & 3, IGNOU, Maidan Garhi, New Delhi-110068 Email: registrarsrd@ignou.ac.in
5	Purchase of Audio/Video CDs	Marketing Unit, EMPC, IGNOU, Maidan Garhi, New Delhi-110068 Email: empcmktunit@ignou.ac.in
6	Academic Content	Director of the School concerned (www.ignou.ac.in)
7	Approval of a Project Synopsis	Project Co-ordinator in the Concerned School of Studies/ Regional Centres
8.	International Students residing in India should contact	Director, International Division, IGNOU, Block-15, Section K, Maidan Garhi, New Delhi. Tel. Nos. : 29533987; 29571681 E-mail : internationaldivision@ignou.ac.in

9	Issue of Degree/ Diploma Certificate/ Despatch of returned Degrees/ Verification of Degrees/Convocation	011-29572213 011-29535438	Asstt. Registrar 011-29572224	convocation@ignou.ac.in
10	Issue of Hall Ticket/ Correction in the hall ticket for handicapped student s/ Non-receipt of hall tickets for term-end- examination & Entrance Test/Entrance, Test Results/Queries related to dispatch of attendance, list of examinees etc./ writer	011-29572209 011-29572202	Asstt. Registrar 011-29535064	bhavna@ignou.ac.in ssbhandari@ignou.ac.in examiii@ignouac.in
11	Declaration of results of Masters & Bachelors degree level programme/Issueof grade card and provisional certificate of Masters and Bachelors degree level prog./ Practical marks of all programmes	011-29572212	Section Officer 011-29536103	mdresult@ignou.ac.inbdresult@ignou.ac.in practicalsed@ignou.ac.in
12	Declaration of results of Masters, Bachelor and Diploma programme/Issue of gradecard and provisional certificate of Masters, Bachelor and Diploma level programme	011-29572211	Section Officer 011-29536743	bdresult@ignou.ac.indpresult@ignou.ac.in

13	Declaration of results of DPE and Certificate programme/ Issue of grade card and provisional certificate of DPE & Certificate level programme	011-29572208	Section Officer 011-29536405	cpresult@ignou.ac.in
14	Verification of genuineness ofprovisional certificate and grade card/ Issue of Transcript	011-29572210	Section Officer 011-29536405	gcverification@ignou.ac.in
15	Queries related to UFM cases	011-29572208 011-29576405	Section Officer	ufmgroup@ignou.ac.in
16	Status of Project Report of all Programmes/ Dissertation and Viva marks	011-29571324 011-29571321	Asstt.Registrar 011-29532294	projects@ignou.ac.in
17	Queries related to Assignment Marks	011-29571325 011-29571319	Asstt.Registrar 011-29571313	assignment@ignou.ac.in
18	Students general enquiries and grievances/ Issue of duplicate mark sheet	011-29572218 011-29571313	Asstt. Registrar	sedgrievance@ignou.ac.in
29	Discrepancy in grade card, non updation of grade/marks in the grade card etc.	011-29572208 011-29572211 011-29572212	Dy. Director/ Asstt.Director	mdresult@ignou.ac.in bdresult@ignou.ac.in bdpresult@ignou.ac.in dpresult@ignou.ac.in cpresult@ignou.ac.in

Telephone numbers of the Divisions/ Schools are also provided on the website under the “Contact Us” option. Students are advised to be in touch with their LSCs for advance/timely/day-to-day information or visit the website with URL www.ignou.ac.in

7 QUESTION PAPER PATTERN

The old question papers of MSCAIML are not available.

Pattern of the theory question papers is as follow:

- Each question paper consists of 5 questions. Time: 3 Hours, Maximum Marks: 100
- Question No. 1 is compulsory which carries 40 marks.
- Question no. 2 to 5 are 20 marks each. Answer any three questions from these.

Pattern of the Practical question papers is as follow:

- Each question paper consists of 1 or 2 compulsory sections.
  Time: 2 Hours, Maximum Marks: 50.

Details of evaluation scheme for lab courses are given in section 4.0.

8 BROWSING IGNOU'S WEBSITE AND SOME USEFUL LINKS

The IGNOU's website is a dynamic source of latest information and is subject to continuous updates. Thus, various pages shown here may change in future. IGNOU itself is continuously changing to bring about improvement in quality of its services. You must visit IGNOU website for all the latest information, filling up or downloading various form, downloading of assignments, results etc.

Navigation from Home Page

The learners can have access to IGNOU's website at the following address (URL) ***https:// www.ignou.ac.in.*** As students get connected to this site, the following page displays the Home Page of IGNOU's web site (Figure 1). Students need to click on various options to get the related information.

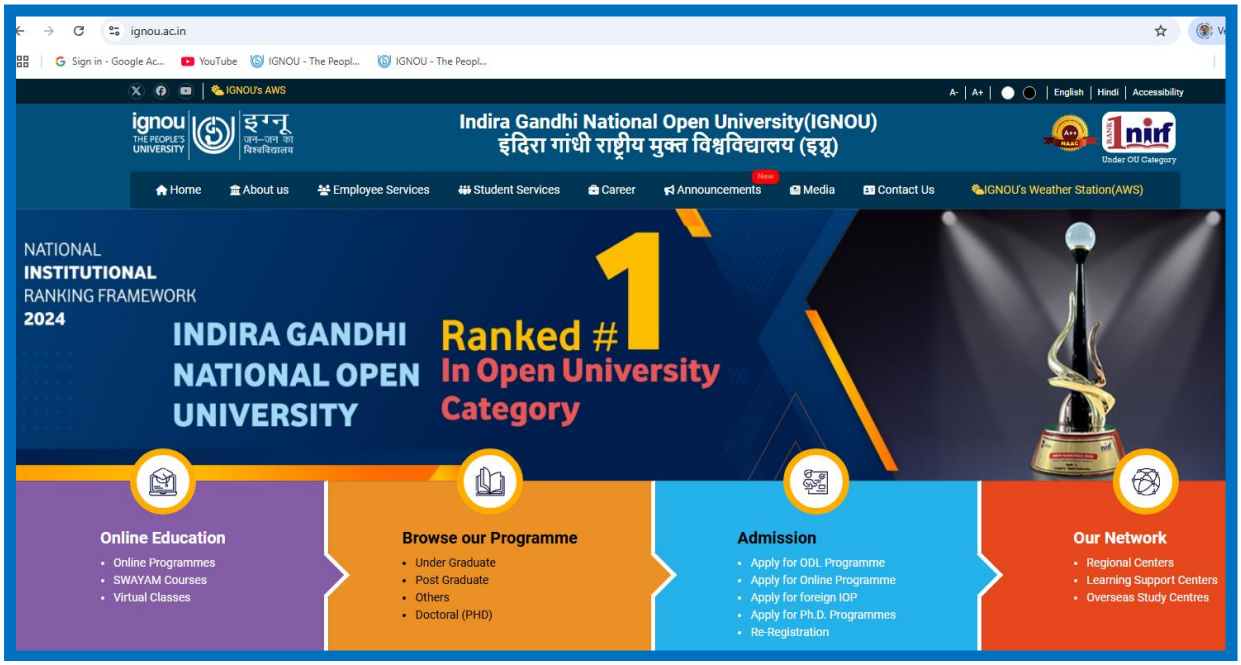

Figure 1: IGNOU Website

From this **Home page** Select **About IGNOU,** which will display an Option List select **School of Studies.** It will show you a page of all the schools of studies of IGNOU, Select **School of Computer and Information Sciences (SOCIS)** to display page of SOCIS (Figure 2). School of Computer and Information Sciences (SOCIS) offers PhD in Computer Science, MCA, MSCAIML, BCA, PGDCA, CMAD and CIT programmes, you can click on **Our Programmes** link on SOCIS page to get the list of programmes on offer as shown in Figure 2.

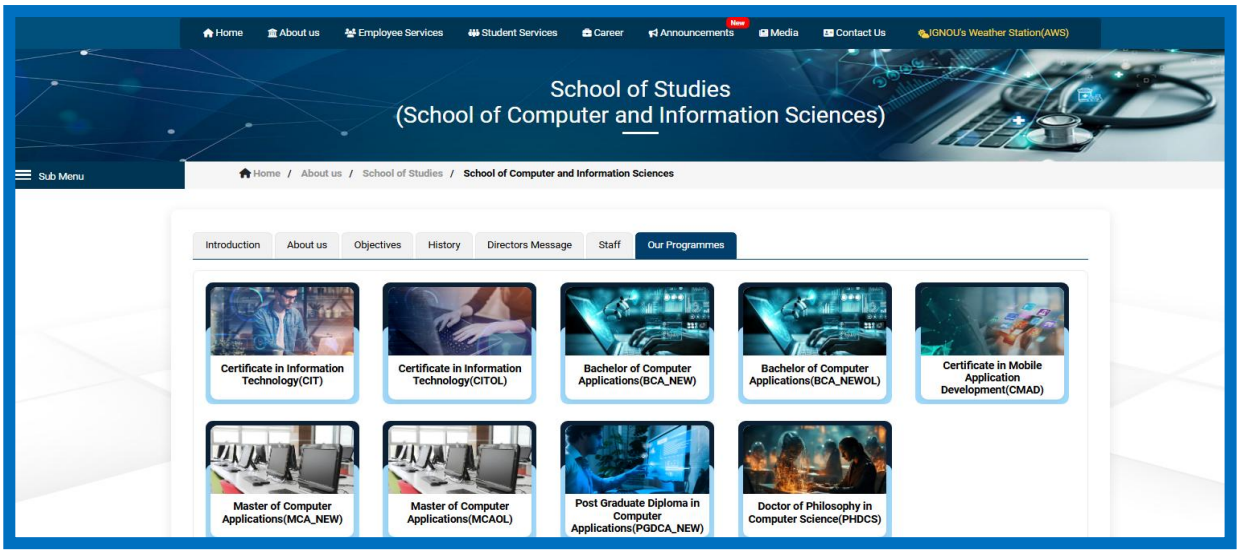

Figure 2: SOCIS Programmes

One of the most important links for students is Student Services which can be reached from Home page by selecting Student Services option. (Link address: *https://www.ignou.ac.in/pages/4*). Figure 3 displays the options of the Student Services page.

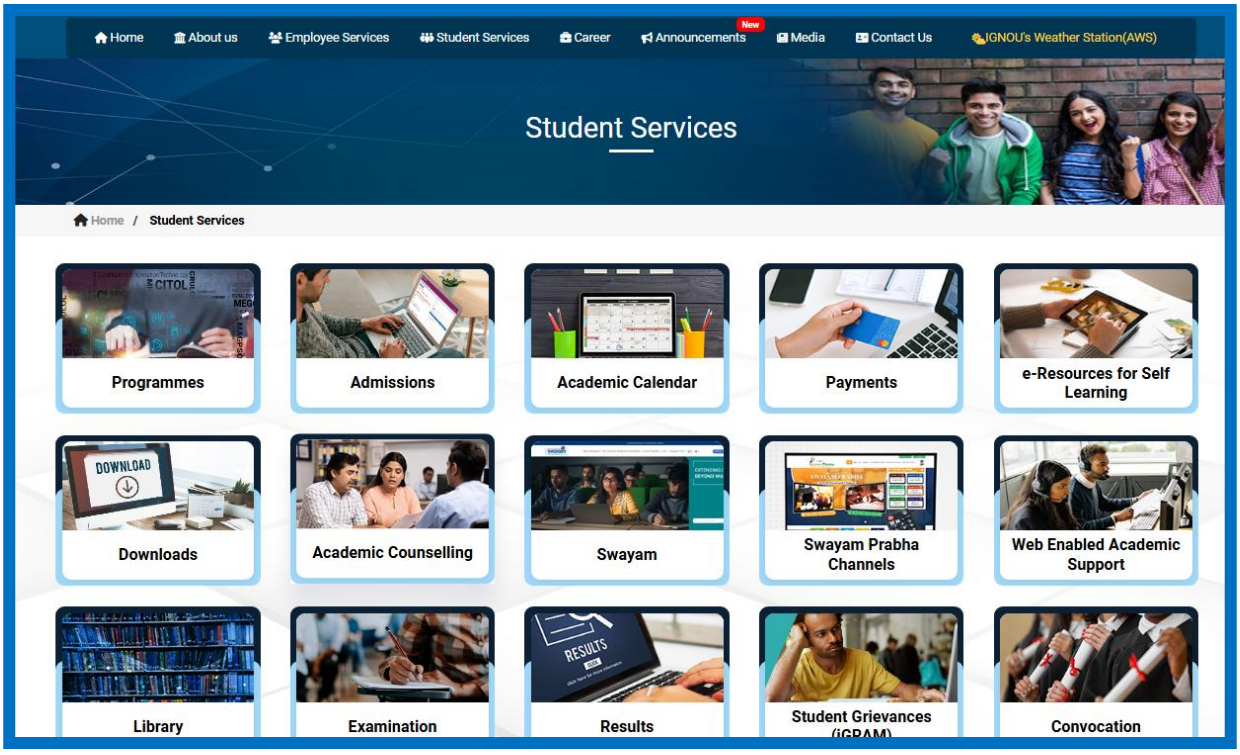

Figure 3: Student Services page

KNOW YOUR STATUS

Under the **Student Services page**one can opt for **Know Your Status** option. Figure 4 will display the result of *Know Your Status* Pagewhereclicking on Check Your Registration Status, you will need to submit the details related to your programme.

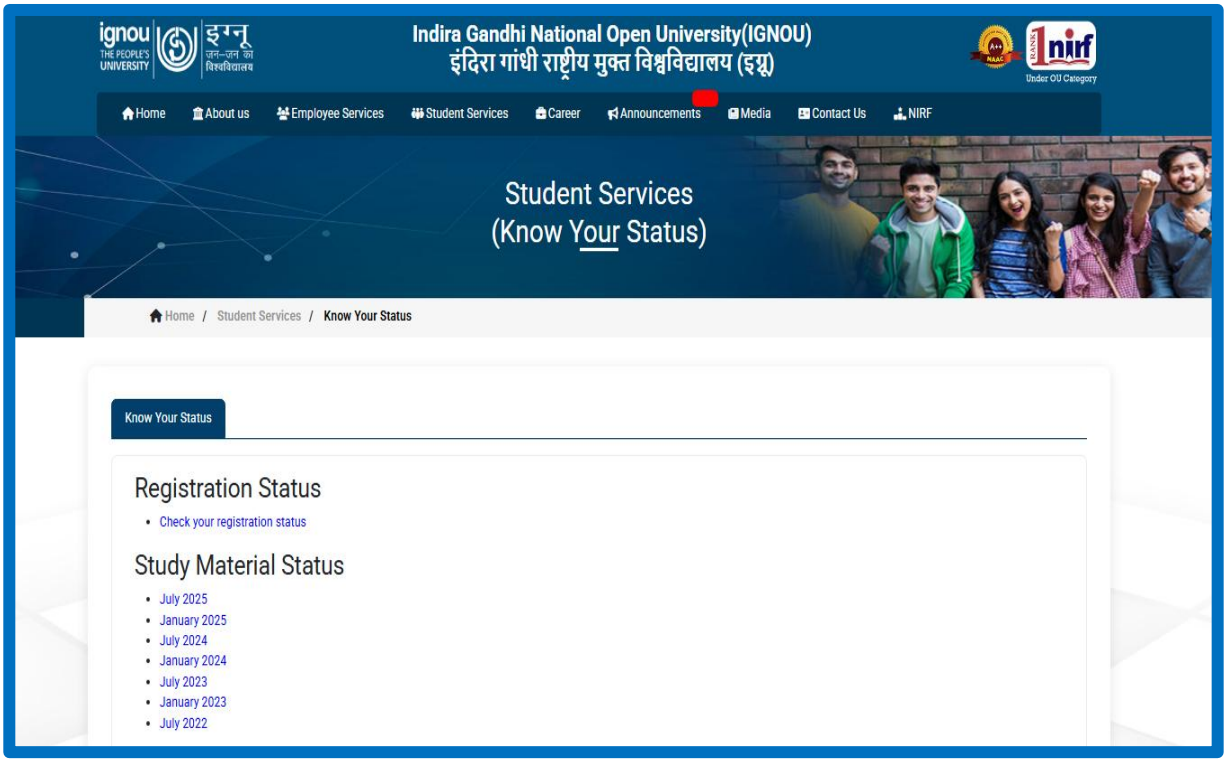

Figure 4: Know Your Status Page will display the above links

Submitting the required details, **Downloads heading** will be displayed on the left side of the page**shown in the Figure-5.**

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Figure-5: Downloads options displayed

On clicking the first link (Formats (Re Registration, Address Change, TEE, Revaluation, Re-admission), you may get the information regarding the Re-Registration, Address Change, TEE, Revaluation, Re-admission etc.

SOME OTHER USEFUL LINKS:

To facilitate easy access to important academic and administrative resources, learners of the M.Sc. (Artificial Intelligence and Machine Learning) (MSCAIML) programme are advised to make use of the following online links provided by the University. These links enable students to download assignments, apply for examinations, and access various support services conveniently.

Link to Latest Assignments

Learners may download the latest assignments for all courses of the programme from the official IGNOU website or directly from the eGyanKosh repository.

URL: https://www.ignou.ac.in/studentService/download/assignments

Assignments are an integral component of the evaluation system. Students must ensure timely submission of the same at their respective Learner Support Centres (LSCs) as per the schedule notified by the University.

Link for Online Re-registration

Re-registration for the subsequent semester(s) or year(s) of the programme should be completed online through the following link:

URL: https://onlinerr.ignou.ac.in/

Students are advised to review their course details carefully before submission and to retain a printed acknowledgment for future reference.

Link for Online Term-End Examination Form

Learners are required to submit their Term-End Examination (TEE) forms through the online portal within the prescribed deadlines.

URL: https://exam.ignou.ac.in/

Please verify the course codes and examination centre details before submission. Admit cards/hall tickets are made available online prior to the commencement of examinations.

Link for Re-evaluation of Answer Scripts

Students who wish to apply for re-evaluation of their answer scripts may submit their request online using the following link:

URL: https://onlineservices.ignou.ac.in/reevaluation/

It is important to refer to the relevant notification for the prescribed time frame and fee structure before submission.

Note:

All learners are strongly encouraged to visit the official IGNOU website (https://www.ignou.ac.in) and the eGyanKosh portal (https://www.egyankosh.ac.in) regularly for updates, announcements, and academic resources related to the MSCAIMLprogramme.