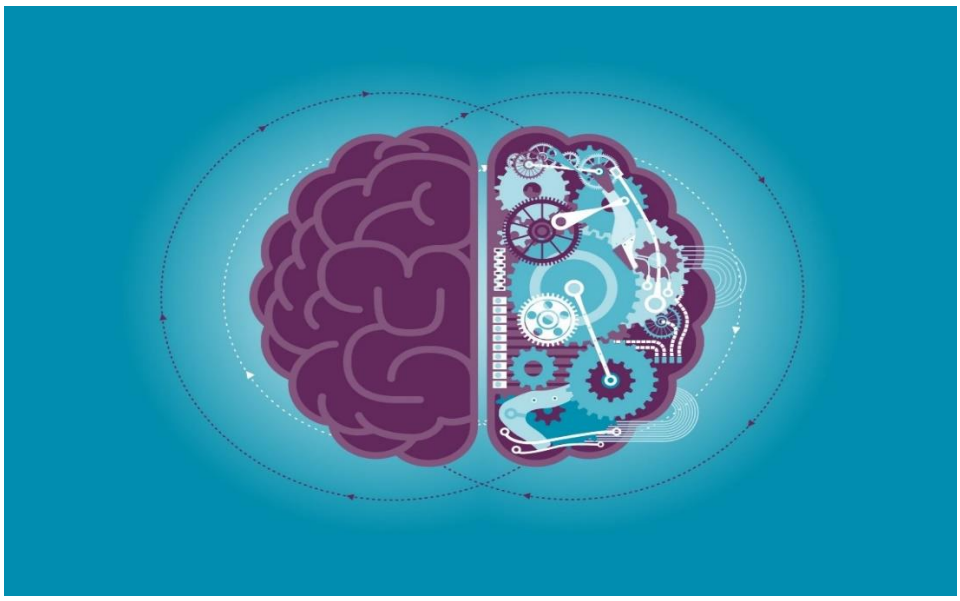
COMPETENCY BASED CURRICULUM

DIPLOMA
IN
ARTIFICIAL INTELLIGENCE & MACHINE LEARNING

(Duration 3 Years)

NSQF Level – 5



Under

Haryana State Board of Technical Education

Developed By

Curriculum Development Center

National Institute of Technical Teachers Training & Research

(Ministry of Education, Government of India)

Sector - 26, Chandigarh, UT, India.

(September, 2024)

PREFACE

Learning and learning experience are the foundation of any education system. Appropriateness of education and its useful implications stand on the platform of knowledge and skill. But the knowledge and skill cannot be quantified qualitatively without ensuring learning experience. Curriculum is the pathway to select and organise learning experience. It helps the teachers to provide tangible resources, goals and objectives to learners. Curriculum acts as a catalyst to stimulate creativity, innovation, ethics, values, responsibility and many human factors. Curriculum embodies rigour and high standards and creates coherence to empower learner to meet the industrial and societal needs. Curriculum is a central guide for a teacher to plan a standard based sequence for the instructional delivery.

The industrial revolution 4.0 has forced the technical education system to reinvent the curriculum to meet the human resource requirement of the industry. The data driven systems relying on the subjects like machine-learning, Artificial Intelligence, Data Science etc are literally forcing the technical education system to offer different subjects differently to address the emerging challenges. The non-linear way of learning now facilitates students to choose path of knowledge to skill or vice-versa. The bi-directional process requires innovative curriculum design and revision. Diploma programme is now more challenging than ever. The level of skill and knowledge demanded by industry from diploma holders are highly interdisciplinary at the same time address special need. Hence, there is a need to align the curriculum to National Skill Qualification Framework (NSQF).

National Education Policy, NEP-2020 has now opened up diversities for the education system to explore and exploit to make the education relevant. The policy emphasises to inculcate value, ethics, respect to culture and society etc along with industry ready knowledge and skill among the students. The interdisciplinary nature of curriculum, academic bank of credits and integration of technology in teaching-learning envisaged in NEP-2020 make it more challenging for curriculum development. NITTTR, Chandigarh has developed the art of curriculum development over 54 years of its existence. The expertise and experience available in the institute follow time-tested and acclaimed scientific methods to design/revise curriculum. The experienced faculty members entrusted with the curriculum development or revision activities are well-versed with NSQF, NEP and Outcome based education. I am happy to note that **Haryana State Board of Technical Education, Punchkula, Haryana** reposed their confidence on this expertise to develop **AICTE/NSQF/NEP 2020** aligned curriculum for the state. This documented curriculum is an outcome of meticulous planning and discussions among renowned experts of the subject through series of workshops. The effective implementation of this curriculum supported with quality instructional resources will go a long way in infusing the learning experience among learners to make them industry ready.

Director

National Institute of Technical Teachers Training & Research, Chandigarh

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Professor and Head
Curriculum Development Center
National Institute of Technical Teachers Training & Research, Chandigarh

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1. SALIENT FEATURES

1.	Name	:	**Diploma in Artificial Intelligence & Machine Learning**
2.	Duration	:	**03 Years**
3.	Hours per week	:	**35**
4.	Entry Qualification	:	**10th Pass**
5.	Student Intake	:	**As per sanctioned strength**
6.	Pattern	:	**Semester**
7.	Scheme	**:**	**Multipoint Entry and Exit**
8.	NSQF Level	:	**5**
9.	Theory Practical Ratio	:	**37 : 63**
10.	Project Work	:	**Minor and Major Project**
11.	In-house/Industrial Internship	:	**Mandatory after First and Second Year**

2. NSQF GUIDELINES

National Skill Qualification Framework has defined total Ten Levels. Each level of the NSQF is associated with a set of descriptors made up of five outcome statements, which describe in general terms, the minimum knowledge, skills and attributes that a learner needs to acquire in order to be certified for that level.

Fig1: NSQF Domains

NSQF LEVEL - 3 COMPLIANCE

The NSQF level - 3 descriptor is as follows:

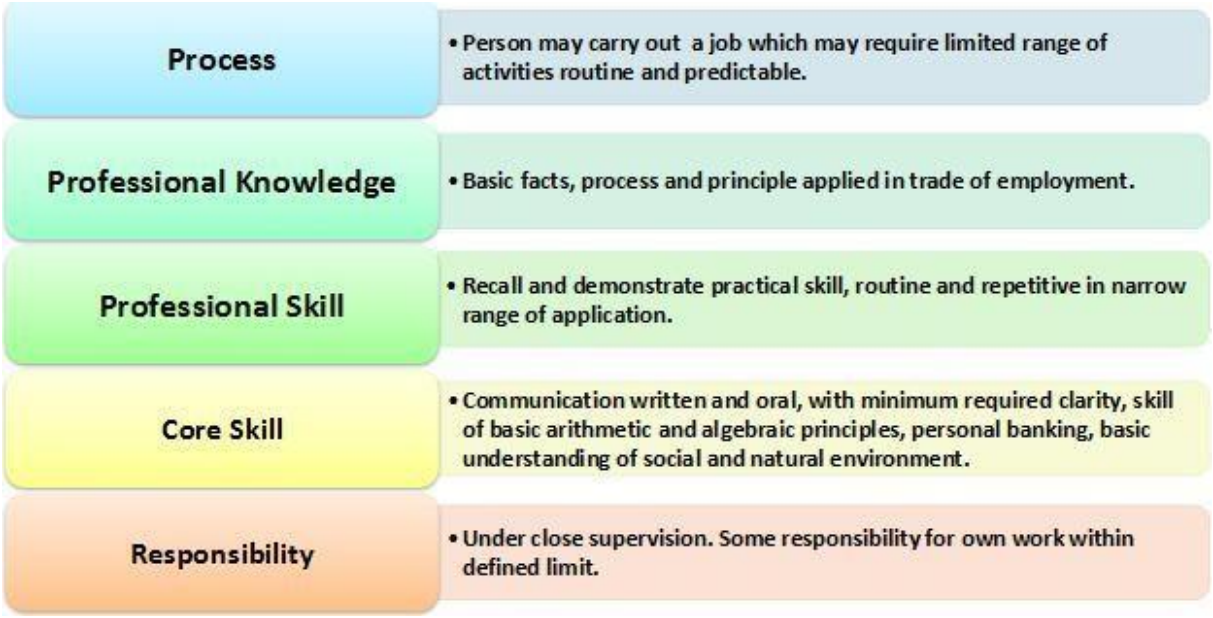

Fig 2: NSQF Level – 3 Descriptor

Work requiring knowledge, skills and aptitudes at level 3 will be routine and predictable. Job holders will be responsible for carrying out a limited range of jobs under close supervision. Their work may require the completion of a number of related tasks. People carrying out these job roles may be described as "Semi skilled workers". Individuals in jobs which require level 3 qualifications will normally be expected to be able to communicate clearly in speech and writing and may be required to use arithmetic and algebraic processes. They will be expected to have previous knowledge and skills in the occupation and should know the basic facts, processes and principles applied in the trade for which they are qualified and be able to apply the basic skills of the trade to a limited range of straightforward jobs in the occupation.

They will be expected to understand what constitutes quality in their job role and more widely in the sector or sub-sector and to distinguish between good and bad quality in the context of the jobs they are given. Job holders at this level will be expected to carry out the jobs they are given safely and securely. They will work hygienically and in ways which show an understanding of environmental issues. This means that they will be expected to take responsibility for their own health and safety and that of fellow workers and, where appropriate, customers and/or clients. In working with others, they will be expected to conduct themselves in ways which show a basic understanding of the social environment. They should be able to make a good contribution to team work.

NSQF LEVEL - 4 COMPLIANCE

The NSQF level-4 descriptor is given below:

Process	• Work in familiar, predictable, routine, situation of clear choice
Professional Knowledge	• Factual knowledge of field of knowledge or study.
Professional Skill	• Recall and demonstrate practical skill, routine and repetitive in narrow range of application, using appropriate rule and tool, using quality concepts.
Core Skill	• Communication written and oral, with required clarity, skill of basic arithmetic and algebraic principles, personal banking, basic understanding of social and natural environment.
Responsibility	• Responsibility for own work and learning.

Fig 3: NSQF Level – 4 Descriptor

Work requiring knowledge, skills and aptitudes at level 4 will be carried out in familiar, predictable and routine situations. Job holders will be responsible for carrying out a range of jobs, some of which will require them to make choices about the approaches they adopt. They will be expected to learn and improve their practice on the job. People carrying out these jobs may be described as "skilled workers". Individuals in jobs which require level 4 qualifications should be able to communicate clearly in speech and writing and may be required to use arithmetic and algebraic processes. They will be expected to have previous knowledge and skills in the occupation in which they are employed, to appreciate the nature of the occupation and to understand and apply the rules which govern good practice. They will be able to make choices about the best way to carry out routine jobs where the choices are clear.

They will be expected to understand what constitutes quality in the occupation and will distinguish between good and bad quality in the context of their job roles. Job holders at this level will be expected to carry out their work safely and securely and take full account of the health and safety on colleagues and customers. They will work hygienically and in ways which show an understanding of environmental issues. In working with others, they will be expected to conduct themselves in ways which show a basic understanding of the social and political environment. They should be able to guide or lead teams on work within their capability.

NSQF LEVEL - 5 COMPLIANCE

The NSQF level-5 description is given below:

Process	• Job that requires well developed skill, with clear choice of procedures in familiar context.
Professional Knowledge	• Knowledge of facts, principles, processes and general concepts, in a field of work or study.
Professional Skill	• A range of cognitive and practical skills required to accomplish tasks and solve problems by selecting and applying basic methods, tools, materials and information.
Core Skill	• Desired mathematical skill; understanding of social, political; and some skill of collecting and organising information, communication.
Responsibility	• Responsibility for own work and learning and some responsibility for others' works and learning

Fig 4: NSQF Level – 5 Descriptor

Work requiring knowledge, skills and aptitudes at level 5 will also be carried out in familiar situations, but also ones where problems may arise. Job holders will be able to make choices about the best procedures to adopt to address problems where the choices are clear. Individuals in jobs which require level 5 qualifications will normally be responsible for the completion of their own work and expected to learn and improve their performance on the job. They will require well developed practical and cognitive skills to complete their work. They may also have some responsibility for others' work and learning. People carrying out these jobs may be described as "fully skilled workers" or "supervisors".

Individuals employed to carry out these jobs will be expected to be able to communicate clearly in speech and writing and may be required to apply mathematical processes. They should also be able to collect and organise information to communicate about the work. They will solve problems by selecting and applying methods, tools, materials and information. They will be expected to have previous knowledge and skills in the occupation, and to know and apply facts, principles, processes and general concepts in the occupation. They will be expected to understand what constitutes quality in the occupation and will distinguish between good and bad quality in the context of their work. They will be expected to operate hygienically and in ways which show an understanding of environmental issues. They will take account of health and safety issues as they affect the work they carry out or supervise.In working with others, they will be expected to conduct themselves in ways which show an understanding of the social and political environment.

3. NATIONAL EDUCATION POLICY (NEP) - 2020

NEP 2020 aims at a comprehensive holistic education to develop all capacities of human beings - intellectual, aesthetic, social, physical, emotional, and moral - in an integrated manner. A holistic arts education will help develop well-rounded individuals that possess: critical 21st century capacities in fields across the arts, humanities, languages, sciences, social sciences, and professional, technical, and vocational fields; an ethic of social engagement; soft skills, such as communication, discussion and debate; and rigorous specialization in a chosen field or fields. Such a holistic education shall be, in the long term, the approach of all undergraduate programmes, including those in professional, technical, and vocational disciplines.

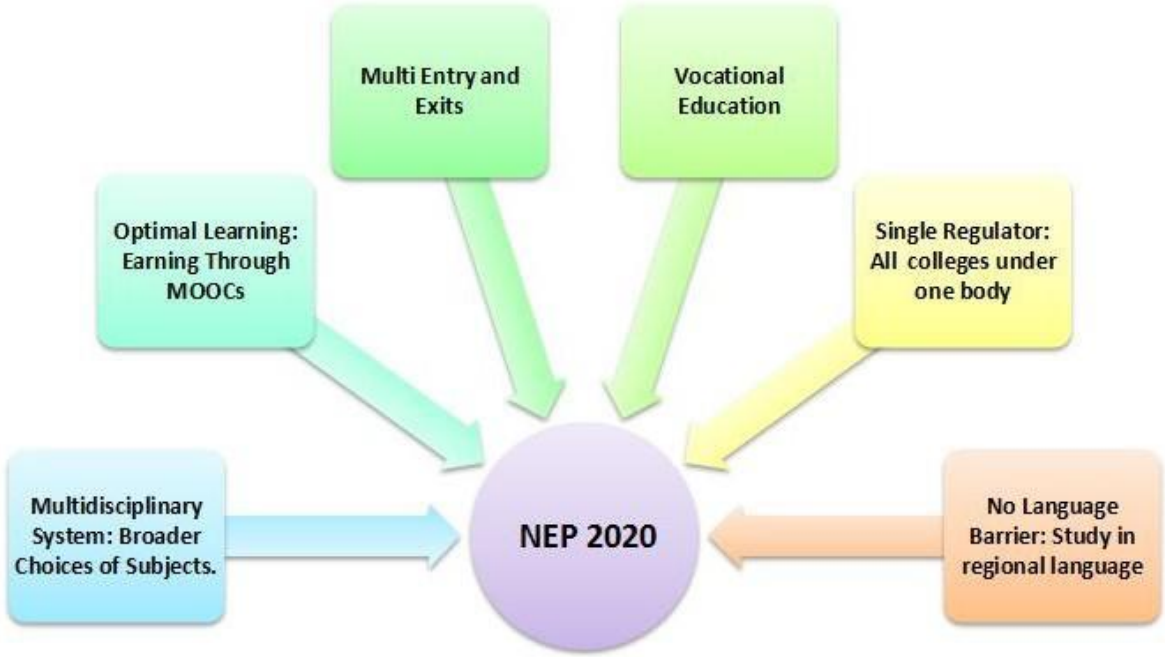

Fig 5: NEP 2020

Flexibility in curriculum and novel and engaging course options will be on offer to students, in addition to rigorous specialisation in a subject or subjects. Pedagogy for courses will strive for significantly less rote learning and an increased emphasis on communication, discussion, debate, research, and opportunities for cross-disciplinary and interdisciplinary thinking. The flexible and innovative curriculum shall emphasize on offering credit-based courses and projects in the areas of community engagement and service, environmental education and value-based education. As part of a holistic education, students will be provided with

opportunities for internships with local industry, businesses, artists, crafts persons, villages and local communities, etc., as well asresearch internships with faculty and researchers at their own or other HEIs or research institutions, so that students may actively engage with the practical side of their learning and, as a by-product, further improve their employability.

Effective learning requires relevant curriculum, engaging pedagogy, continuous formative assessment and adequate student support. The curriculum must be updated regularly aligning with the latest knowledge requirements and shall meet specified learning outcomes. High-quality pedagogy is then necessary to successfully impart the curricular material to students; pedagogical practices determine the learning experiences that are provided to students - thus directly influencing learning outcomes. The assessment methods have to be scientific and test the application of knowledge. Higher Education Institutes should move to a criterion-based grading system that assesses student achievement based on the learning goals for each programme, making the system fairer and outcomes more comparable. HEIs should also move away from high-stakes examinations towards more continuous and comprehensive evaluation.

4. PROGRAM OUTCOMES

The program outcomes are derived from five domains of NSQF Level namely Process, Professional Knowledge, Professional Skill, Core Skill, Responsibility. After completing this programme, the student will be able to:

PO1: Acquire knowledge of basic mathematics, sciences and basic engineering to understand Artificial Intelligence & Machine Learning.

PO2: Identify principles, processes and professional knowledge to solve broad-based Artificial Intelligence & Machine Learning problems

PO3: Improve the knowledge in finding solutions and developing Machine learning models for real time problems in various domains

PO4: Demonstrate skill of communication, basic mathematics, collecting and organizing information along with knowledge of social, political and natural environment.

PO5: Take the responsibility to work as dedicated data science expert who is capable of identifying solutions to various problems faced by the society.

PO6: Engage in Multi-disciplinary skills, team spirit and leadership qualities with professional ethics, to excel in professional career and/or higher studies in Artificial Intelligence.

5. DERIVING CURRICULUM AREAS FROM PROGRAMME OUTCOMES

The following curriculum areas have been derived from Programme outcomes:

Sr. No.	Programme Outcomes	Curriculum Subjects / Areas
1.	**PO1:** Acquire knowledge of basic mathematics, sciences and basic engineering to understand Artificial Intelligence & Machine Learning.	• Applied Physics – I • Applied Mathematics - I • Applied Mathematics-II • Applied Physics – II • Programming through C • Data Science using Python • Digital Electronics & Microcontrollers • JAVA Technologies • Algorithm Design Techniques
2.	**PO2:** Identify principles, processes and professional knowledge to solve broad based Artificial Intelligence & Machine Learning problems.	• Applied Physics - I • ComputerWorkshop • Applied Physics – II • FundamentalsofIT • Fundamentals of Artificial Intelligence • Principles of Data Structures • Digital Electronics & Microcontrollers • Machine Learning • Big Data Analytics
3.	**PO 3 :** Improve the knowledge in finding solutions and developing Machine learning models for real time problems in various domains	• Programming through C • Fundamentals of Artificial Intelligence • Web Technology • Industrial / In - House Training. • Data Science using Python • Neural Networks • Machine Learning • Internet of Things • Deep Learning and its applications • AI Expert systems

4.	**PO4:** Demonstrate skill of communication, basic mathematics, collecting and organizing information along with knowledge of social, political and natural environment.	• English and Communication Skills I-II • Applied Mathematics - I– II. • Fundamentals of IT. • Environmental Studies & Disaster Management. • Entrepreneurship Development & Management. • Software Tools for Artificial Intelligence and Machine Learning.
5.	**PO 5:**Take the responsibility to work as dedicated data science expert who is capable of identifying solutions to various problems faced by the society.	• Principles of Data Structures • Web Technology • Computer Workshop • JAVA Technologies • Software Tools for Artificial Intelligence and Machine Learning • Major Project/Industrial Training • Minor Project • Entrepreneurship Development & Management • Linux & Its Application • Big Data Analytics • AI Expert systems
6.	**PO6:**Engage in Multi-disciplinary skills, team spirit and leadership qualities with professional ethics, to excel in professional career and/or higher studies in Artificial Intelligence.	• Multidisciplinary Elective • Open Elective • Computer Networks • Relational Database Management • Cloud Computing

FIRST YEAR
NSQF LEVEL - 3

FIRST YEAR
6. STUDY AND EVALUATION SCHEME

FIRST SEMESTER:

Sr. No.	SUBJECTS	STUDY SCHEME Periods/Week		Credits (C) L + P = C	MARKS IN EVALUATION SCHEME						Total Marks of Internal & External
					INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT			
		L	P		Th	Pr	Total	Th	Pr	Total	
1.1	*English and Communication Skills - I	2	2	**2 + 1 = 3**	40	40	80	60	60	120	200
1.2	*Applied Mathematics - I	4	-	**4 + 0 = 4**	40	-	40	60	-	60	100
1.3	*Applied Physics - I	2	2	**2 + 1 = 3**	40	40	80	60	60	120	200
1.4	*Fundamentals of IT	2	4	**2 + 2 = 4**	40	40	80	60	60	120	200
1.5	Programming through C	3	6	**3 + 3=6**	40	40	80	60	60	120	200
1.6	**Computer Workshop	-	6	**0 + 3=3**	-	40	40	-	60	60	100
# Student Centered Activities(SCA)		-	2	-	-	-	-	-	-	-	-
Total		**13**	**22**	**23**	**200**	**200**	**400**	**300**	**300**	**600**	**1000**

***** Common with other Diploma Courses.

** Common with Diploma in Computer Engineering.

Student Centered Activities will comprise of co-curricular activities like extension lectures on Constitution of India, Games, Yoga, Human Values & Ethics, Knowledge of Indian System, Hobby clubs e.g. Photography etc., Seminars, Declamation contests, Educational field visits, N.C.C, NSS, Cultural Activities and self-study etc.

SECOND SEMESTER:

Sr. No.	SUBJECTS	STUDY SCHEME Periods/Week		Credits (C) L + P = C	MARKS IN EVALUATION SCHEME						Total Marksof Internal & External
					INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT			
		L	P		Th	Pr	Total	Th	Pr	Total	
2.1	Principles of Data Structures	3	6	**3 + 3 = 6**	40	40	80	60	60	120	200
2.2	*Applied Mathematics-II	4	-	**4 + 0 = 4**	40	-	40	60	-	60	100
2.3	*Applied Physics - II	2	2	**2 + 1 = 3**	40	40	80	60	60	120	200
2.4	Fundamentals of Artificial Intelligence	4	-	**4 + 0 = 4**	40	-	40	60	-	60	100
2.5	Web Technology	2	4	**2 + 2 = 4**	40	40	80	60	60	120	200
2.6	*Environmental Studies & Disaster Management	2	-	**2 + 0 = 2**	40	-	40	60	-	60	100
# Student Centered Activities (SCA)		-	6	-	-	-	-	-	-	-	-
Total		**17**	**18**	**23**	**240**	**120**	**360**	**360**	**180**	**540**	**900**

***** Common with other Diploma Courses

\# Student Centered Activities will comprise of co-curricular activities like extension lectures on Constitution of India, Games, Yoga, Human Values & Ethics, Knowledge of Indian System, Hobby clubs e.g. Photography etc., Seminars, Declamation contests, Educational field visits, N.C.C., NSS, Cultural Activities and self-study etc.

Summer Industrial/In-house Training: After 2nd semester, students shall undergo Summer Training of minimum 4 Weeks.

7. HORIZONTAL AND VERTICAL SUBJECTS ORGANISATION

Sr. No.	Subjects/Areas	Hours Per Week	
		First Semester	Second Semester
1.	English and Communication Skills - I	4	-
2.	Applied Mathematics - I	4	-
3.	Applied Physics - I	4	-
4.	Fundamentals of IT	6	-
5.	Programming through C	9	-
6.	Computer Workshop	6	-
7.	Principles of Data Structures		9
8.	Applied Mathematics-II	-	4
9.	Applied Physics - II	-	4
10.	Fundamentals of Artificial Intelligence	-	4
11.	Web Technology	-	6
12.	Environmental Studies & Disaster Management	-	2
13.	Student Centered Activities	2	6
	Total	**35**	**35**

8. COMPETENCY PROFILE & EMPLOYMENT OPPORTUNITIES

Artificial Intelligence (AI) and Machine Learning (ML) are increasingly becoming part of our modern lives and are found everywhere in form of virtual chats, Cellphone Assistants, geographic maps navigation, digital assistants or self-driving cars. Artificial Intelligence and Machine Learning leads to innovative products and services and has achieved spectacular successes for business and science. Artificial Intelligence is correlated by machine learning and it is among the most trending technologies for creating intelligent machines or software.

These two technologies are the most trending ones for creating intelligent systems. Artificial Intelligence and Machine Learning or AI can be defined as the science of developing machines capable of thinking like humans, which focuses on the concept of which can stimulate human thinking, behaviors, etc. in machines including learning, reasoning, and self-correction.

The NSQF Level – 3 pass out students are expected to recall and demonstrate practical routine and repetitive skills, in narrow range of Ai & ML. In government and private sectors, “Semi Skilled workers” are required to carry out a limited range of predictable tasks under close supervision. They are normally expected to communicate clearly in speech and along with knowledge of arithmetic and algebraic processes.

With the rapid technological developments in the field, artificial intelligence is one of the most sought after skills by large technology companies. With many forecasters deeming that computers will take over many manufacturing jobs, programming artificial intelligence is a job for the future. Below are some examples of jobs common for skilled professionals with knowledge in artificial intelligence, robotics, machine learning, and related fields, including a brief job description of each role.

With a diploma in AI, there are several employment opportunities available, including:

1. Machine Learning Engineer: As a machine learning engineer, you would be responsible for designing and implementing machine learning algorithms that can learn from data and improve over time.

2. Data Scientist: As a data scientist, you would be responsible for collecting, analyzing, and interpreting complex data using various tools and techniques to extract meaningful insights.

3. AI Developer: As an AI developer, you would be responsible for designing, developing, and implementing AI applications, such as chatbots, recommendation systems, and image recognition systems.

4. Robotics Engineer: As a robotics engineer, you would be responsible for designing and developing intelligent robotic systems that can perform complex tasks in various industries, such as manufacturing and healthcare.

5. Natural Language Processing (NLP) Engineer: As an NLP engineer, you would be responsible for designing and developing algorithms that can understand and interpret human language, such as chatbots, virtual assistants, and sentiment analysis tools.

6. AI Consultant: As an AI consultant, you would be responsible for advising companies on how to leverage AI technologies to improve their business operations and gain a competitive advantage.

7. AI Product Manager: As an AI product manager, you would be responsible for managing the development of AI products, from ideation to launch, and ensuring they meet customer needs and business goals.

9. PROGRAMME OUTCOMES

The programme outcomes are derived from five domains of NSQF Level – 3 namely Process, Professional Knowledge, Professional Skill, Core Skill, Responsibility. After completing this programme, the student will be able to:

PO1: Perform out a task which may require limited range of predictable activities related to the Artificial Intelligence & Machine Learning.

PO2: Acquire knowledge of facts, process and principles related to Artificial Intelligence & Machine Learning for sustainability and employment.

PO3: Demonstrate the ability to identify, formulate and analyze real-life data scientist problems.

PO4: Communicate accurately and appropriately and demonstrate professional behavior along with skill of basic arithmetic and algebraic principles, and basic understanding of social and natural environment.

PO5: Be responsible to perform task under close supervision with some responsibility within defined limit.

10. ASSESSMENT OF PROGRAMME AND COURSE OUTCOMES

Programme Outcomes to be assessed	Assessment criteria for the Course Outcomes
PO1: Perform out a task which may require limited range of predictable activities related to the Artificial Intelligence & Machine Learning.	• Formulate engineering problems into mathematical formats with the use matrices, co-ordinate geometry and trigonometry. • Identify physical quantities, select their units for use in engineering solutions, and make Measurements with accuracy. • Represent physical quantities as scalar and vector and identify type of motions, various forms of energy, their conversion and applications. • Acquire moderate level understanding of the physics behind the electrical engineering materials. • Formulate the engineering problems into mathematical format with the use of differential equations and differentia • Use the differentiation and Integration in solving various Mathematical and Engineering problems. • Learn about basic fundamentals about MATLAB/ SciLab and mathematical calculation with MATLAB/ SciLab software. • Comprehend the basics of file handling mechanisms • Define and manage data structures based on problem subject domain. • Work efficiently with textual information, characters and strings.

PO2: Acquire knowledge of facts, process and principles related to Artificial Intelligence & Machine Learning for sustainability and employment.	• Formulate engineering problems into mathematical formats with the use matrices, co-ordinate geometry and trigonometry • Calculate the approximate value of roots of certain expressions in engineering problems by application of binomial theorem. • Explore the idea of location, graph, and linear relationships between two variables. • Learn about basic fundamentals about MATLAB/ SciLab and mathematical calculation with MATLAB/ SciLab software. • Elaborate scientific work, energy and power, forms of friction and solve problems related to them. • Formulate the engineering problems into mathematical format with the use of differential equations and differential • Use the differentiation and Integration in solving various Mathematical and Engineering problems. • Discuss the purposes of measures of central tendency and calculate the measures of central tendency (mode, median, mean) for a set of data. • Identify the suitable data structures to solve the problem and formulate an algorithm. • Comprehend the strength and weakness of different data structures and use the appropriate data structure in context of solution of given problem. • Implement basic data structures such as arrays, linked lists, stacks and queues • Give an overview of the field of artificial intelligence • Interpret and formulate knowledge representations in the form of logic expressions • Explain basic concepts, methods and theories of neural networks and learning

	• Create web pages using HTML and Cascading Style Sheets • Develop a well-designed, interactive Web site with respect to current standards and practices. • Illustrate the usage of Content Management Systems (CMS)
PO3: Demonstrate the ability to identify, formulate and analyze real-life data scientist problems.	• Use the differentiation and Integration in solving various Mathematical and Engineering problems. • Learn about basic fundamentals about MATLAB/ SciLab and mathematical calculation with MATLAB/ SciLab software. • Comprehend the basics of file handling mechanisms • Define and manage data structures based on problem subject domain. • Work efficiently with textual information, characters and strings. • Troubleshoot and Maintain PC/Laptop • Create web pages using HTML and Cascading Style Sheets. • Develop a well-designed, interactive Web site with respect to current standards and practices. • illustrate the usage of Content Management Systems (CMS) • Demonstrate the knowledge about Machine learning and its contrast with Deep Learning • Apply Algorithm for solving problems like sorting, searching, insertion and deletion of data • Develop programming skills which require to solve given problem. • Work efficiently with textual information, characters and strings. • Apply code reusability with functions and pointers.

PO4: Communicate accurately and appropriately and demonstrate professional behavior along with skill of basic arithmetic and algebraic principles, and basic understanding of social and natural environment.	• Identify the nuances of Communication, both Oral and Written. • Acquire knowledge of the meaning of communication, communication process and speaking skills. • Acquire enhanced vocabulary and in-depth understanding of Grammatical Structures and their usage in the communication. • Communicate effectively with an increased confidence to read, write and speak in English language fluently. • Illustrate the geometric shapes used in engineering problems by Co-ordinate Geometry and Trigonometry. • Formulate engineering problems into mathematical formats with the use matrices, co-ordinate geometry and trigonometry • Calculate the approximate value of roots of certain expressions in engineering problems by application of binomial theorem. • Explore the idea of location, graph, and linear relationships between two variables. • Explain the basic components of Computers, Internet and issues of abuses/ attacks on information and computers • Handle the computer/laptop/mobiles/Internet Utilities and Install/Configure OS • Assemble a PC and connect it to external devices • Manage and Use Office practiced Automation Tools • Develop worksheets and Prepare presentations • Comprehend the importance of sustainable ecosystem. • Clarify interdisciplinary nature of environmental issues.

	• Describe corrective measures for the abatement of pollution. • Identify the role of non-conventional energy resources in environmental protection. • Recognize various types of disasters.
PO5: Be responsible to perform task under close supervision with some responsibility withindefined limit.	• Learn about basic fundamentals about MATLAB/ SciLab and mathematical calculation with MATLAB/Sci Lab software. • Comprehend the basics of file handling mechanisms • Define and manage data structures based on problem subject domain. • Work efficiently with textual information, characters and strings. • Apply code reusability with functions and pointers • Implement basic data structures such as arrays, linked lists, stacks and queues • Apply Algorithm for solving problems like sorting, searching, insertion and deletion of data • Develop programming skills which require to solve given problem. • Interpret and formulate knowledge representations in the form of logic expressions • Explain basic concepts, methods and theories of neural networks and learning. • Demonstrate the knowledge about Machine learning and its contrast with Deep Learning • Illustrate the concept of NLP and Computer vision • Analyze a web page and identify its elements and attributes • Create web pages using HTML and Cascading Style Sheets • Develop a well-designed, interactive Web site with respect to current standards and practices.

11. SUBJECTS & CONTENTS (FIRST YEAR)

FIRST SEMESTER

1.1 ENGLISH & COMMUNICATION SKILLS – I

L	P
2	2

RATIONALE

Language as the most commonly used medium of self-expression remains indispensable in all spheres of human life –personal, social and professional. This course is intended to break fresh ground in teaching of Communicative English as per the requirements of National Skill Quality Framework. This course is designed to help students to acquire the concept of communication and develop an ability or skills to use them effectively to communicate with the individuals and community.

COURSE OUTCOMES

After undergoing this course, the students will be able to:

CO1: Identify the nuances of Communication, both Oral and Written.

CO2: Acquire knowledge of the meaning of communication, communication process and speaking skills.

CO3: Acquire enhanced vocabulary and in-depth understanding of Grammatical Structures and their usage in the communication.

CO4: Communicate effectively with an increased confidence to read, write and speak in English language fluently.

DETAILED CONTENTS

UNIT I

Reading

1.1 Techniques of reading: Skimming and Scanning

1.2 Extensive and Intensive Reading: Textual Study

1.3 Homecoming – R.N. Tagore

1.4 Life Sketch of Sir Mokshagundam Visvesvarayya

1.5 Life Sketch of Dr. Abdul Kalam

1.6 Narayan Murthy's speech at LBSNA, Dehradun

UNIT II

Fundamentals of Communication

2.1 Concept and Process of Communication,

2.2 Types of Communication (Verbal Communication)

2.3 Barriers to Communication
2.4 Speaking Skill: Significance and essentials of Spoken Communication
2.5 Listening Skill: Significance and essentials of Listening

UNIT III

Grammar and Usage

3.1 Nouns
3.2 Pronouns
3.3 Articles
3.4 Verbs(Main and Auxiliary)
3.5 Tenses

UNIT IV

Writing Skills

4.1 Significance, essentials and effectiveness of Written Communication
4.2 Notice Writing
4.3 Official Letters and E-mails.
4.4 Frequently-used Abbreviations used in Letter-Writing
4.5 Paragraph Writing
4.6 Netiquettes

PRACTICAL EXERCISES

1. Reading

Reading Practice of lessons in the Lab Activity classes.

i. Comprehension exercises of unseen passages along with the lessons prescribed.
ii. Vocabulary enrichment and grammar exercises based on the selected readings.
iii. Reading aloud Newspaper headlines and important articles.

2. Fundamentals of Communication

i. Introducing oneself, others and leave- taking(talking about yourself)
ii. Just a minute (JAM) sessions: Speaking extempore for one minute on given topics
iii. Situational Conversation: Offering-Responding to offers; Congratulating; Apologizing and Forgiving; Complaining; Talking about likes and dislikes, Self-introduction Mock Interviews

3. Grammar and Usage

i. Written and Oral Drills will be undertaken in the class to facilitate holistic linguistic competency among learners.
ii. Exercises on the prescribed grammar topics.

4. Writing Skills

i. Students should be given Written Practice in groups so as to inculcate team-spirit and collaborative learning .
ii. Group exercises on writing paragraphs on given topics.
iii. Opening an e-mail account, receiving and sending emails

RECOMMENDED BOOKS

1) Alvinder Dhillon and Parmod Kumar Singla, "Text Book of English and Communication Skills Vol – 2", M/S Abhishek Publications, Chandigarh.
2) V Sasikumar & PV Dhamija, "Spoken English", Tata MC Graw Hills, New Delhi, Second Edition.
3) JK Gangal, "A Practical Course in Spoken English", PHI Learning Pvt. Ltd., New Delhi.
4) NK Aggarwal and FT Wood, "English Grammar, Composition and Usage", Macmillan Publishers India Ltd., New Delhi.
5) RC Sharma and Krishna Mohan, "Business Correspondence & Report writing", Tata MC Graw Hills, New Delhi, Fourth Edition.
6) Kavita Tyagi & Padma Misra, "Professional Communication", PHI Learning Pvt. Ltd., New Delhi.
7) Nira Konar, "Communication Skills for professionals", PHI Learning Pvt. Ltd., New Delhi.
8) Krishna Mohan & Meera Banerji, "Developing Communication Skills", Macmillan Publishers India Ltd., New Delhi, Second Edition
9) M. Ashraf Rizwi, "Effective Technical Communication", Tata MC Graw Hills, New Delhi.
10) Andrea J Rutherfoord, "Basic Communication Skills for Technology", Pearson Education, New Delhi.

INSTRUCTIONAL STRATEGY

This is practice based subject and topics taught in the class should be practiced as exercises in the Lab regularly for development of communication skills in the students. The students should be involved in activities to enhance their personality skills. This subject contains four units of equal weightage.

1.2 APPLIED MATHEMATICS - I

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4	-

RATIONALE

Contents of this course provide fundamental base for understanding engineering problems and their solution algorithms. Contents of this course will enable students to use basic tools like logarithm, binomial theorem, matrices, t-ratios and co-ordinates for solving complex engineering problems with exact solutions in a way which involve less computational task. By understanding the logarithm, they will be able to make long calculations in short time and it is also a pre-requisite for understanding Calculus.

COURSE OUTCOMES

After undergoing this course, the students will be able to:

CO1: Illustrate the geometric shapes used in engineering problems by Co-ordinate Geometry and Trigonometry.

CO2: Formulate engineering problems into mathematical formats with the use matrices, co-ordinate geometry and trigonometry

CO3: Calculate the approximate value of roots of certain expressions in engineering problems by application of binomial theorem.

CO4: Explore the idea of location, graph, and linear relationships between two variables.

CO5: Learn about basic fundamentals about MATLAB/ SciLab and mathematical calculation with MATLAB/ SciLab software.

DETAILED CONTENTS

UNIT I Algebra

1.1 Complex Numbers: definition of complex number, real and imaginary parts of a complex number, Polar and Cartesian Form and their inter conversion, Conjugate of a complex number, modulus and amplitude, addition subtraction, multiplication and division of complex numb

1.2 Logarithms and its basic properties

UNIT II Binomial Theorem, Determinants and Matrices

2.1 Meaning of ${}^{n}P_{r}$ & ${}^{n}C_{r}$ (mathematical expression). Binomial theorem (without proof) for positive integral index (expansion and general form); binomial theorem for any index (expansion up to 3 terms - without proof), first binomial approximation with application to engineering problems.

2.2 Determinants and Matrices – Evaluation of determinants (upto 2nd order), solution of equations (upto 2 unknowns) by Crammer's rule, definition of Matrices and its types, addition, subtraction and multiplication of matrices (upto 2nd order).

UNIT III Trigonometry

3.1 Concept of angle, measurement of angle in degrees, grades, radians and their conversions.

3.2 T-Ratios of Allied angles (without proof), Sum, Difference formulae and their applications (without proof). Product formulae (Transformation of product to sum, difference and vice versa

3.3 Applications of Trigonometric terms in engineering problems such as to find an angle of elevation, height, distance etc.

UNIT-IV Co-ordinate Geometry

4.1 Cartesian and Polar co-ordinates (two dimensional), Distance between two points, mid-point, centroid of vertices of a triangle.

4.2 Slope of a line, equation of straight line in various standards forms (without proof); (slope intercept form, intercept form, one-point form, two-point form, symmetric form, normal form, general form), intersection of two straight lines, concurrency of lines, angle between straight lines, parallel and perpendicular lines, perpendicular distance formula, conversion of general form of equation to the various forms.

UNIT V Geometry of Circle and Software

Circle

5.1 General equation of a circle and its characteristics. To find the equation of a circle, given:

i. Centre and radius
ii. Three points lying on it
iii. Coordinates of end points of a diameter

Software

5.2 **MATLAB or SciLab software –** Theoretical Introduction, MATLAB or Scilab as Simple Calculator (Addition and subtraction of values –Trigonometric and Inverse Trigonometric functions) – General Practice

RECOMMENDED BOOKS

1. R. D. Sharma, "Applied Mathematics – I & II for Diploma Courses", Dhanpat Rai Publications.
2. "Mathematics for Class XI", NCERT Publication, New Delhi.
3. "Mathematics for Class XII", NCERT Publication, New Delhi.
4. H. K Dass, "Applied Mathematics for Polytechnics", CBS Publishers & Distributers.

5. A Ganesh and G Balasubramanian, “Textbook of Engineering Mathematics – I”, CBS Publisher, New Delhi.
6. A Ganesh and G Balasubramanian, “Textbook of Engineering Mathematics –II”, CBS Publisher, New Delhi.
7. G. B. Thomas, R. L. Finney, “Calculus and Analytic Geometry”, Addison Wesley, Ninth Edition.
8. B S Grewal, “Elementary Engineering Mathematics”, Khanna Publishers, Delhi, Thirty-fifth Edition.
9. R.K. Jain and S.R.K. Iyengar, “Advanced Engineering Mathematics”, Narosa Publishing House, New Delhi, Second Edition, 2003.
10. SS Sabharwal & Dr Sunita Jain, “Applied Mathematics Vol. I & II”, Eagle Parkashan, Jalandhar.
11. S Kohli, “Engineering Mathematics Vol. I & II”, IPH, Jalandhar.
12. Reena Garg & Chandrika Prasad, “Advanced Engineering Mathematics”, Khanna Publishing House, New Delhi
13. R. Pratap, “Getting Started with MATLAB 7”, Oxford University Press, Seventh Edition.
14. E-books/e-tools/relevant software to be used as recommended by AICTE/HSBTE/NITTTR.

SUGGESTED WEBSITES

1. http://swayam.gov.in
2. https://www.scilab.org

INSTRUCTIONAL STATREGY

This is theoretical subject and contains five units of equal weight age.
Basic elements of algebra, trigonometry and co-ordinate geometry can be taught in the light of their applications in the field of engineering and technology. By laying more emphasis on applied part, teacher can also help in providing a good continuing education base to the students. Students need to be taught the skills needed to use software tools built by experts through multiple problem solving based on the topics related to Algebra, Trigonometry and Coordinate Geometry that the industry requires. Examples to be used should be related to engineering. Useful software MATLAB or open source software SciLab can be taught theoretically by books/online literatures and basic operations can be shown practically with practical software laboratory or small mobile apps of these software or authentic Trial version of MATLAB/ SciLab software. Students should be able to relate to the actual use of these examples and the way mathematical calculations will help them in doing their job.

1.3 APPLIED PHYSICS-I

L	P
2	2

RATIONALE

Applied physics includes the study of a large number of diverse topics all related to things that go on in the world around us. It aims to give an understanding of this world both by observation and by prediction of the way in which objects will behave. Concrete use of physical principles and analysis in various fields of technical are given prominence in the course content.

COURSE OUTCOMES

After completing this course, student should be able to:

CO1: Identify physical quantities, select their units for use in engineering solutions, and make measurements with accuracy.

CO2: Represent physical quantities as scalar and vector and identify type of motions, various forms of energy, their conversion and applications.

CO3: Elaborate scientific work, energy and power, forms of friction and solve problems related to them.

CO4: Comprehend properties of matter and effect of temperature on various matter and phenomenon.

CO5: Demonstrate the use of physical principles and analysis in various fields of technology.

DETAILED CONTENTS

UNIT I Unit and Dimensions

1.1 Definition of Physics, physical quantities- fundamental and derived

1.2 Units: fundamental and derived

1.3 System of units: CGS, FPS, MKS, SI

1.4 Dimension, dimensional formulae and SI units of physical quantities-distance, displacement, area, volume, density, velocity, acceleration, linear momentum, force, impulse, work, power, energy, pressure, surface tension, stress, strain)

1.5 Dimensional equations, principle of homogeneity of dimensional equation

1.6 Application of dimensional analysis: checking the correctness of physical equation, conversion of system of unit (force, work, acceleration)

UNIT II

Force and Motion

2.1 Scalar and vector quantities– definition and examples, representation of vector, types of vector (unit vector, position vector, co-initial vector, collinear vector, co-planar vector)

2.2 Vector algebra- addition of vectors, Triangle & Parallelogram law (statement and formula only),

2.3 Scalar and vector product (statement and formula only)

2.4 Force and its units, resolution of force (statement and formula only)

2.5 Newton's laws of motion (statement and examples)

2.6 Linear momentum, Law of conservation of linear momentum (statement and examples), Impulse

2.7 Circular motion: definition of angular displacement, angular velocity, angular acceleration, frequency, time period; Relation between linear and angular velocity, centripetal and centrifugal forces (definition and formula only), application of centripetal force in banking of road

2.8 Rotational motion: definition with examples

2.9 Definition of torque, angular momentum, moment of inertia and its physical significance

UNIT III

Work, Power and Energy

3.1 Work- definition, symbol, formula and SI unit, types of work (zero work, positive work and negative work) with example

3.2 Friction– definition and its simple daily life applications

3.3 Power- definition, formula and units

3.4 Energy- definition and its SI unit, examples of transformation of energy.

3.5 Kinetic energy- definition, examples, formula and its derivation

3.6 Potential energy- definition, examples, formula and its derivation

3.7 Law of conservation of mechanical energy for freely falling bodies (with derivation)

3.8 Simple numerical problems based on formula of Power and Energy

UNIT IV

Properties of Matter

4.1 Elasticity and plasticity- definition, deforming force, restoring force, example of elastic and plastic body

4.2 Definition of stress and strain, Hooke's law, modulus of elasticity

4.3 Pressure- definition, atmospheric pressure, gauge pressure, absolute pressure, Pascal's law

4.4 Surface tension- definition, SI unit, applications of surface tension, effect of temperature on surface tension

4.5 Viscosity: definition, unit, examples, effect of temperature on viscosity

UNIT V

Heat and Temperature

5.1 Definition of heat and temperature (on the basis of kinetic theory)

5.2 Difference between heat and temperature

5.3 Principle and working of mercury thermometer

5.4 Modes of transfer of heat- conduction, convection and radiation with examples.

5.5 Properties of heat radiation

5.6 Different scales of temperature and their relationship

PRACTICE EXERCISES

1. Familiarization of measurement instruments and their parts (for example - vernier calliper, screw gauge, spherometer, travelling microscope etc.), and taking a reading. (compulsory to all students)
2. To find diameter of solid cylinder using a vernier calliper
3. To find internal diameter and depth of a beaker using a vernier calliper and hence find its volume.
4. To find the diameter of wire using screw gauge
5. To find thickness of paper using screw gauge.
6. To determine the thickness of glass strip using a spherometer
7. To determine radius of curvature of a given spherical surface by a spherometer.
8. To verify parallelogram law of force
9. To determine the atmospheric pressure at a place using Fortin's Barometer
10. To determine force constant of spring using Hooke's law
11. Measuring room temperature with the help of thermometer and its conversion in different scale.

RECOMMENDED BOOKS

1. "Text Book of Physics for Class XI (Part-I, Part-II)", N.C.E.R.T., Delhi.
2. Dr. HH Lal, "Applied Physics, Vol. I and Vol. II", TTTI Publications, Tata McGraw Hill, Delhi.
3. AS Vasudeva, "Applied Physics – I", Modern Publishers, Jalandhar.
4. R A Banwait, "Applied Physics – I", Eagle Prakashan, Jalandhar.
5. E-books/e-tools/relevant software to be used as recommended by AICTE/ HSBTE/ NITTTR.
6. C. L. Arora, "Practical Physics", S Chand Publication.

SUGGESTED WEBSITES

1. http://swayam.gov.in
2. The Physics Classroom
3. https://www.khanacademy.org/science/physics

INSTRUCTIONAL STATREGY

This is hands-on practice based subject and topics taught in the class should be practiced in the Lab regularly for development of required skills in the students. This subject contains five units of equal weightage.

Teacher may use various teaching aids like models, charts, graphs and experimental kits etc. for imparting effective instructions in the subject. Students need to be exposed to use of different sets of units and conversion from one unit type to another. Software may be used to solve problems involving conversion of units. The teacher should explain about field applications before teaching the basics of mechanics, work, power and energy, rotational motion, properties of matter etc. to develop proper understanding of the physical phenomenon. Use of demonstration can make the subject interesting and develop scientific temper in the students. Teachers should give examples of engineering/technology applications of various concepts and principles in each topic so that students are able to appreciate learning of these concepts and principles. In all contents, SI units should be followed. Working in different sets of units can be taught through relevant software.

1.4 FUNDAMENTALS OF IT

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2	4

RATIONALE

Information technology has great influence on all aspects of life. Almost all work places and living environment are being computerized. In order to prepare diploma holders to work in these environments, it is essential that they are exposed to various aspects of information technology such as understanding the concepts of information technology and its scope, operating a computer: use of various office management tools, using internet and mobile applications etc. This course is intended to make new students comfortable with computing environment - Learning basic computer skills, learning basic application software tools, Understanding Computer Hardware, Cyber security awareness.

COURSE OUTCOMES

At the end of the course student will be able to

CO1: Explain the basic components of Computers, Internet and issues of abuses/ attacks on information and computers
CO2: Handle the computer/laptop/mobiles/Internet Utilities and Install/Configure OS
CO3: Assemble a PC and connect it to external devices
CO4: Manage and Use Office practiced Automation Tools
CO5: Develop worksheets and Prepare presentations

DETAILED CONTENTS

UNIT I Basics of Computer

Brief history of development of computers, Definition of Computer, Block diagram of a Computer, Hardware, Software, Booting: Cold and Hot Booting, Interaction between the CPU and Memory with Input/Output devices, Function of CPU and major functional parts of CPU.
Memory, Bit, Nibble, Byte, KB, MB, GB, TB, PB, Functions of memory, Use of storage devices in a Computer, List types of memory used in a Computer, Importance of cache memory, CPU speed and CPU word length

UNIT II Basic Internet Skills

Understanding browser, Introduction to WWW, efficient use of search engines, awareness about Digital India portals (state and national portals) and college portals. Advantages of Email, Various email service providers, Creation of email id, sending and receiving emails, attaching documents with email and drive.

Effective use of Gmail, G-Drive, Google Calendar, Google Sites, Google Sheets, Online mode of communication using Google Meet & WebEx.

Unit III Basic Logic building

Introduction to Programming, Steps involved in problem solving, Definition of Algorithm, Definition of Flowchart, Steps involved in algorithm development, differentiate algorithm and flowchart, symbols used in flowcharts, algorithms for simple problems, flowcharts for simple problems, Practice logic building using flowchart/algorithms

Unit IV

Office Tools

Office Tools like LibreOffice/OpenOffice/MSOffice.

OpenOffice Writer – Typesetting Text and Basic Formatting, Inserting Images, Hyperlinks, Bookmarks, Tables and Table Properties in Writer

Introducing LibreOffice/OpenOffice *Calc*, Working with Cells, Sheets, data, tables, using formulae and functions, using charts and graphics.

OpenOffice Impress – Creating and Viewing Presentations, Inserting Pictures and Tables, Slide Master and Slide Design, Custom Animation.

Unit V Use of Social Media

Introduction to Digital Marketing – Why Digital Marketing, Characteristics of Digital Marketing, Tools for Digital Marketing, , Effective use of Social Media like LinkedIn, Google+, Facebook, Twitter, etc.: Features of Social media, Advantages and Disadvantages of Social Media.

PRACTICE EXERCISES

1. Browser features, browsing, using various search engines, writing search queries
2. Visit various e-governance/Digital India portals, understand their features, services offered
3. Read Wikipedia pages on computer hardware components, look at those components in lab, identify them, recognize various ports/interfaces and related cables, etc.
4. Using Administrative Tools/Control Panel Settings of Operating Systems
5. Connect various peripherals (printer, scanner, etc.) to computer, explore various features of peripheral and their device driver software.
6. Explore features of Open Office tools and MS-Office, create documents, create presentation, create spread sheet, using these features, do it multiple times
7. Working with Conversion Software like pdfToWord, WordToPPT, etc.
8. Working with Mobile Applications – Searching for Authentic Mobile app, Installation and Settings, Govt. of India Mobile Applications

9. Creating email id, sending and receiving mails with attachments.
10. Using Google drive, Google calendar
11. Create Flow chart and Algorithm for the following
    i. Addition of n numbers and display result
    ii. To convert temperature from Celsius to Fahrenheit
    iii. To find Area and Perimeter of Square
    iv. Swap Two Numbers
    v. find the smallest of two numbers
    vi. Find whether given number is Even or Odd
    vii. To print first n even Numbers
    viii. find sum of series 1+2+3+…..+N
    ix. print multiplication Table of a number
    x. generate first n Fibonacci terms 0,1,1,2,3,5…n (n>2)
    xi. sum and average of given series of numbers
    xii. Factorial of number n (n!=1x2x3x…n)
    xiii. Armstrong Number
    xiv. Find whether given number is Prime or not

RECOMMENDED BOOKS

1. R.S. Salaria, “Computer Fundamentals”, Khanna Publishing House.
2. Ramesh Bangia, “PC Software Made Easy – The PC Course Kit”, Khanna Publishing House.
3. Online Resources, Linux man pages, Wikipedia
4. Mokhtar Ebrahim and Andrew Mallett, “Mastering Linux Shell Scripting: A practical guide to Linux command-line, Bash scripting, and Shell programming”.
5. Vikas Gupta, “Comdex Hardware and Networking Course Kit” Dream Tech press, New Delhi, 2008.
6. Sumitabha Das, “UNIX concepts and applications” Tata McGraw Hill, New Delhi, 2008, Fourth Edition.

SUGGESTED WEBSITES

1. https://nptel.ac.in/courses/106/106/106106222/ - NPTEL Course on Modern Application Development
2. https://onlinecourses.swayam2.ac.in/aic19_de01/preview -
3. https://spoken-tutorial.org/ - Tutorials on Introduction to Computers, HTML, LibreOffice Tools, etc.
4. NOTEPAD++
5. https://tms-outsource.com/blog/posts/web-development-ide/

INSTRUCTIONAL STRATEGY

This is a skill based subject and topics taught in the class should be practiced in the Lab regularly for development of required skills in the students. This subject contains five units of equal weight age.

1.5 PROGRAMMING THROUGH C

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RATIONALE

Developing a software for real world problems essentially requires a thorough knowledge and understanding of problem solving process. C Programming is one of the oldest programming languages around and despite the prevalence of higher-level languages, it continues to empower the world. C is a general-purpose language, ideal for building mostly state-of-the-art system. C language is a vehicle in the present industrial context which provides opportunity to use logical thinking abilities for acquisition of programming skills. This will be reinforced by the practical exercises. The course also provides hands-on training to help students write and test your coding skill, and prepare students for real-life application.

COURSE OUTCOMES

At the end of this course, the student will be able to:

CO1: Control the sequence of the program and give logical outputs
CO2: Comprehend the basics of file handling mechanisms
CO3: Define and manage data structures based on problem subject domain.
CO4: Work efficiently with textual information, characters and strings.
CO5: Apply code reusability with functions and pointers

DETAILED CONTENTS

UNIT I

Algorithm and Programming

Problem solving techniques – algorithms and flowcharts, basics of programming language,steps in development of a program, program compilation and debugging, Exploring C Programming.

UNIT II

Program & Control Structure

Input/output statements, assignment statements, constants, variables and data types, operators and expressions, use of header files and library functions. Introduction to control structures, decision making with if – statement, if – else and Nested if, while and do- while, until, for loop, switch and break statements.

Introduction to functions, global and local variables, function definition, declaration and function call, parameters and parameter passing techniques – call by value/ reference.

UNIT III

Arrays & Strings

Introduction to arrays, array declaration and initialization, single and multidimensional array, arrays of characters. Introduction to strings, declaring and initializing string variables, reading and writing strings, stringhandling functions, array of strings.

UNIT IV

Pointers

Introduction to pointers, address operator and pointers, declaring and initializing pointers, assignment through pointers, pointers and functions, pointers and arrays.

UNIT V

Structures and Unions

Declaration of structures, accessing structure members, structure initialization, arrays of structure, unions, differences between structure and union.

PRACTICE EXERCISES

1. Programming exercises on executing and editing a C program.
2. Programming exercises on defining variables and assigning values to variables.
3. Programming exercises on arithmetic and relational operators.
4. Programming exercises on arithmetic expressions and their evaluation
5. Programming exercises on formatting input/output using printf and scanf.
6. Programming exercises using if statement.
7. Programming exercises using if – Else.
8. Programming exercises on switch statement.
9. Programming exercises on do – while statements.
10. Programming exercises on for – statement.
11. Programming exercises on function – Call by value/reference
12. Programs on one-dimensional array.
13. Programs on two-dimensional array.
14. Simple programs on string handling functions.
15. Simple programs using pointers.
16. Simple programs using structures.

RECOMMENDED BOOKS

1. "Programming in C", Schaum Series, McGraw Hills Publishers, New Delhi.
2. Yashwant Kanetkar, "Let Us C" BPB Publication, New Delhi.

3. RS Salaria, “Application Programming in C” Khanna Book Publishing Co. (P) Ltd., NewDelhi.
4. R Subburaj, “Programming in C” Vikas Publishing House Pvt. Ltd., Jangpura, New Delhi.
5. C Balaguruswami, “Programming with C Language” Tata McGraw Hill, New Delhi.
6. BP Mahapatra, “Programming in C” Khanna Publishers, New Delhi

INSTRUCTIONAL STRATEGY

This is hands-on practice based subject and topics taught in the class should be practiced in the Lab regularly for development of required skills in the students. This subject contains five units of equal weightage. Students should be given clear idea about the basic concepts of programming. In practical session student should be asked to write algorithm and then write program for the algorithm and run on computer. It is required that students should maintain records (files with printouts).

1.6 COMPUTER WORKSHOP

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RATIONALE

The diploma holder needs to understand computer fundamentals and information technology. They should be able to operate basic software related to computer. This course is to provide the students a clear exposure of types of computers, computer components and interfaces, input/output devices and Installation/assembly.

COURSE OUTCOMES

At the end of the course student will be able to

CO1: Identify and Handle various hardware components

CO2: Install different types of software and use them appropriately

CO3: Assemble computer components

CO4: Interface various devices to PC/Laptop

CO5: Troubleshoot and Maintain PC/Laptop

PRACTICAL EXERCISES

UNIT I

Introduction

Anatomy of a Computer, Foundations of Modern Information Technology, The Central Processing Unit, How Microprocessors and Memory Chips are Made, Memory, Buses for Input and Output, communication With Peripherals.

Desktop: Identification of desktop and its parts, Hardware, Software and Firmware

Introduction to Mother board, IO and memory expansion slots, Drives, front panel and rear panel

Processors& Bus: Introduction and types of Processor, Introduction to BUS

Laptop: Introduction to Laptop, advantages over Desktops

Laptop components: Adapter – types, Battery – types, Laptop Keyboard and Touchpad

Power Supply: Introduction to online and offline UPS, Difference between online and offline UPS, SMPS: Introduction to SMPS, Study of SMPS Connectors

UNIT II

Memory Storage Devices

Primary Memory: Introduction and types of primary memory (SDRAM, DDR RAM)

Secondary Storage: Hard Disk –Working Principle of IDE, HDD Partition – Formatting, Introduction to SATA and Solid-State Drives (SSD)

Removable Storage: Introduction to CD, DVD, reading & writing operations; Introduction to Blue-ray devices

Flash memory: Flash drives (pen drives), Memory cards and its types

UNIT III

I/O Devices and Interfacing

Inputting Text and Graphics, State of the Art, Input and Output, Pointing Devices, Foundations of Modern Output, Display Screens, Printers, Foundations of Modern Storage, Storage Media, Increasing Data Storage Capacity, Backing up your Data, The Smart Card

Keyboard: Types of keyboards (wired and wireless Keyboard), keyboards connectors, troubleshooting.

Mouse: types, connectors, operation of Optical mouse and Troubleshooting.

Printers: Introduction – Types of printers- Dot Matrix, Inkjet, LaserJet,

MFP (Multi-Function Printer), advantages, disadvantages, cables and connectors, troubleshooting.

I/O Ports: Introduction and identification of Serial, Parallel, USB, HDMI.

Displays: Introduction to LED, LCD and TFT Displays, cables and connectors

Graphic Cards: Introduction to different types of Graphics cards.

UNIT IV

Maintenance and Trouble Shooting of Desktop and Laptops

Bios-setup: Standard CMOS setup, Advanced BIOS setup, advanced chipset features,

PC Bios communication, upgrading BIOS, Flash BIOS -setup.

POST and BOOTING: Definition, POST Test sequence – beep codes.

Diagnostic Software and Viruses: Computer Viruses, Precautions, Anti-virus Software, Working of Antivirus software's

General troubleshooting of various peripheral devices (printer, pc, laptop, keyboard, mouse, monitor, hard disk)

UNIT V

Assembling and Installation of Hardware/Software

Assembling and Disassembling of PC

Installation and Troubleshooting: Formatting, Partitioning and Installation of OS: Windows and Linux, Installation of peripheral devices: Printers, scanner

Installation of software: application and systems software

RECOMMENDED BOOKS

1. Stephen J, Bigelow, "Trouble shooting, maintaining and repairing PCs", Tata McGraw-Hill, New Delhi, 2005.
2. Stanley & Hall, "PC Data Handbook, BPB Publications, New Delhi, 2007.
3. Govindarajulu, "IBM PC and clones Hardware trouble shooting and maintenance, TataMcGraw-Hill, New Delhi, 2007.
4. Scott Muller, "Upgrading and Repairing PCs", Microtech Publications, Dubai, 2006.
5. Ronald L.Krutz, "Interfacing Techniques in Digital Design with Emphasis on Microprocessors", John Wiley & Sons New York, 2004.

SUGGESTED WEBSITES

1. PC Hardware — Open & Free – OLI (cmu.edu)
2. https://www.classcentral.com/course/build-a-computer-3234 : Free Online Course: Build a Modern Computer from First Principles: From Nand to Tetris (Project-Centered Course) from Courser/Class Central

INSTRUCTIONAL STRATEGY

This is hands on practice based workshop and topics taught in the class should be practiced in the workshop regularly for development of required skills in the students. This workshop contains five units of equal weight age.

SECOND SEMESTER

2.1 PRINCIPLES OF DATA STRUCTURES

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3	6

RATIONALE

Data structures are the techniques of designing the basic algorithms for real-life projects. Understanding of data structures is essential and this facilitates the understanding of the language. The practice and assimilation of data structure techniques is essential for programming. The knowledge of 'C' language and data structures will be reinforced by practical exercises during the course of study. The course will help students to understand importance of data structures in context of writing efficient programs and develop the capability of selecting a particular data structure and their implementations.

LEARNING OUTCOMES

After undergoing the subject, the students will be able to:

CO1: Identify the suitable data structures to solve the problem and formulate an algorithm.
CO2: Comprehend the strength and weakness of different data structures and use the appropriate data structure in context of solution of given problem.
CO3: Implement basic data structures such as arrays, linked lists, stacks and queues
CO4: Apply Algorithm for solving problems like sorting, searching, insertion and deletion of data
CO5: Develop programming skills which require to solve given problem.

DETAILED CONTENTS

UNIT I

Fundamental Notations

1.1 Problem solving concept top down and bottom up design, structured programming
1.2 Concept of data types, variables and constants
1.3 Concept of pointer variables and constants

UNIT II

Array and Linked Lists

2.1 Concept of Arrays
2.2 Storage representation of multi-dimensional arrays.
2.3 Operations on arrays with Algorithms (searching, traversing, inserting, deleting)
2.4 Introduction to linked list
2.5 Representation of linked lists in Memory

2.6 Operations on linked list (Insertion, deletion and traversals)
2.7 Application of linked lists
2.8 Doubly linked lists
2.9 Operations on doubly linked lists (Insertion, deletion and traversals)

UNIT III

Stacks, Queues and Recursion

3.1 Introduction to stacks
3.2 Representation of stacks
3.3 Implementation of stacks
3.4 Applications of stacks
3.5 Introduction to queues
3.6 Implementation of queues
3.7 Circular Queues
3.8 De-queues
3.9 Application of Queues
3.10 Recursion

UNIT IV

Trees

4.1 Concept of Trees
4.2 Representation of Binary tree in memory
4.3 Traversing Binary Trees (Pre order, Post order and In order)
4.4 Searching, inserting and deleting binary search trees
4.5 Introduction to Heap

UNIT V

Sorting and Searching

5.1 Introduction to sorting and searching
5.2 Search algorithm (Linear and Binary)
5.3 Sorting algorithms (Bubble Sort, Insertion Sort, Quick Sort, Selection Sort, Merge Sort, Heap Sort

LIST OF PRACTICALS

Write programmes in C to implement

1. Implementation of searching and sorting techniques
2. The addition of two matrices using functions
3. The multiplication of two matrices
4. Push and pop operation in stack
5. Inserting and deleting elements in queue
6. Inserting and deleting elements in circular queue
7. Insertion and deletion of elements in linked list
8. Insertion and deletion of elements in doubly linked list
9. Implementation of list using array and linked list
10. Write a program to solve the problems using iteration/recursion
    a) Factorial of a given number b) Fibonacii series
11. Implementation of priority queue for process scheduling
12. Program for binary search tree operation
13. The selection sort technique:
14. Bubble sort technique b) Quick sort technique c) Merge sort technique
15. Program for storing data as tree structure and implementation of various traversal techniques
16. Program for finding shortest path in graph

RECOMMENDED BOOKS

1. A. Tannenbaum, “Data Structure Using C” , Pearson Education.
2. Robert Kruse, “Data Structure using C” Prentice Hall of India
3. Yashwant Kanekar, “Data Structure through C” BPB Publications
4. ISRD Group, “Data Structure using C” Tata McGraw Hills Education Pvt Ltd.
5. RS Salaria, “Data Structures and Algorithm Using C” Khanna Book Publishing Co. Pvt. Ltd. New Delhi
6. E. Horowitz & Sahni, Fundamental Data Structure, Galgotia Book Source.
7. Goodrich & Tamassia, “Data Structures and Algorithms in C++”, 2nd Edition, John Wiley & Sons, 2011.

SUGGESTED WEBSITE

http://swayam.gov.in

INSTRUCTIONAL STRATEGY

This subject clears all fundamentals of programming techniques. Teachers should stress on explaining all the techniques and algorithms in detail in theory sessions. The students should be asked to convert their ideas about a problem into an algorithm in theory class and implement it in practical class. This willhelp the students to have clear concepts of programming. This is practical based subject and contains five units of equal weight age

2.2 APPLIED MATHEMATICS–II

L	P
4	-

RATIONALE

Applied mathematics forms the backbone of engineering students. Basic elements of Differential calculus, Integral calculus and Differential Equations have been included in this course. This willdevelop analytical abilities to apply in engineering field and will provide continuing educational base to the students.

COURSE OUTCOMES

After undergoing the subject, the students will be able to:

CO1: Formulate the engineering problems in to mathematical format with the use of differential equations and differential

CO2: Use the differentiation and Integration in solving various Mathematical and Engineering problems.

CO3: Calculatetheapproximateareaunderacurvebyapplyingintegrationandnumericalmethods.

CO4: Understand the purposes of measures of central tendency and calculate the measures of central tendency (mode, median, mean) for a set of data.

CO5: Learn about basic fundamentals about MATLAB/SciLab and mathematical calculation with MATLAB/SciLab software.

DETAILED CONTENTS

UNIT I
Differential Calculus

1.1 Definition of function; Concept to flim its (Introduction only) and problems related to four standard limits only.

1.2 Differentiation of x^n, sinx, cosx, e^x by first principle.

1.3 Differentiation of sum, product and quotient of functions.

UNIT II

Differential Calculus and Its Applications

2.1 Differentiation of trigonometric functions, inverse trigonometric functions. Logarithmic differentiation, successive differentiation (upto2ndorder)

2.2 Application of differential calculus in:

(a) Ratemeasures (b) Maximaandminima

UNIT III

Integral Calculus

3.1 Integration as in verse operation of differentiation with simple examples.

3.2 Simplest and integrals and related problems, Integration by Substitution method and Integration by parts.

3.3 Evaluation of definite integrals with given limits.

$$\text{Evaluation of } \int \sin^n x.\,dx, \quad \int_0^{\pi/2} \cos^n x\,dx, \quad \int_0^{\pi/2} \sin^m x \cos^n x\,dx$$

Using formulae without proof (and being positive integers only) using pre-existing mathematical models.

UNIT IV

Application of Integration, Numerical Integration and Differential Equations

4.1 Applications of integration: for evaluation of are aunderacurveandaxes (Simple problems).

4.2 Numerical integration by Trapezoidal Rule and Simpson's $1/3^{rd}$ Rule using pre-existing mathematical models.

Differential Equations

4.3 Definition, order, degree, Type of differential Equations, linearity, Formulation of ordinary differential equation (up to 1^{st} order), solution of ODE (1^{st} order) by variable separation method.

UNIT V

Statistics and Software Statistics

5.1 Measures of Central Tendency: Mean, Median, Mode

5.2 Measures of Dispersion: Mean deviation, Standard deviation

Software

5.3 SciLab software – Theoretical Introduction.

5.4 Basic difference between MATLAB and SciLab software,

5.5 Calculations with MATLAB or ScilLab - (a) Representation of matrix (2×2order), (b) Addition, Subtraction of matrices (2×2order) in MATLAB or SciLab

RECOMMENDED BOOKS

1. R.D.Sharma.“Applied Mathematics–I& II for Diploma Courses”, Dhanpat Rai Publications.
2. “Mathematics for Class XI”, NCERT Publication, New Delhi.
3. “Mathematics for Class XII”, NCERT Publication, New Delhi.
4. H.K Dass, “Applied Mathematics for Polytechnics”, CBS Publishers & Distributers.
5. A Ganesh and G Balasubramanian,“Text book of Engineering Mathematics–I”, CBS Publisher, New Delhi.
6. A Ganesh and G Balasubramanian,“Text book of Engineering Mathematics–II”,CBS Publisher, New Delhi.
7. G.B.Thomas, R.L.Finney,“Calculus and Analytic Geometry”, Addison Wesley, Ninth Edition.
8. BS Grewal, “Elementary Engineering Mathematics”, Khanna Publishers, Delhi, Thirty-fifth Edition.
9. R.K.Jain and S.R.K. Iyengar, “Advanced Engineering Mathematics” Narosa Publishing House, New Delhi, Second Edition, 2003.
10. SSSabharwal&DrSunitaJain,“AppliedMathematicsVol.I&II”,EagleParkashan,Jalandhar.
11. S Kohli, “Engineering Mathematics Vol.I & II”, IPH, Jalandhar.
12. Reena Garg & Chandrika Prasad, “Advanced Engineering Mathematics”, Khanna Publishing House, New Delhi.
13. R. Pratap,“Getting Started with MATLAB7”,Oxford University Press, Seventh Edition.
14. E-books/e-tools/relevant software to be used as recommended by AICTE/HSBTE/NITTTR.

SUGGESTED WEBSITES

1. https://www.scilab.org
2. http://swayam.gov.in

INSTRUCTIONAL STRATEGY

This is theoretical subject and contains five units of equal weight age. Basic elements of Differential Calculus, Integral Calculus, and Differential Equations can be taught in the light oftheir applications in the field of engineering and technology. By laying more stress on appliedpart, teachers can also help in providing continuing education base to the students. Students need to be taught the skills needed to use software tools built by experts through multiple problem solving based on the topics that the industry requires. For example they need to know how to use mathematical models that use integration as opposed to learning how integration can be used. Use unauthenticated software MATLAB or open source software SciLab can be taught theoretically by books/online literatures andbasic operations can be shown practically with practical software laboratory or small mobile apps of these software or authentic Trial version of MATLAB/ SciLab software. Diploma students need to know which tools to use and how to dothe job.

2.3 APPLIED PHYSICS-II

L	P
2	2

RATIONALE

Applied physics includes the study of a large number of diverse topics all related to thingsthatgo on in the world around us. It aims to give an understanding of this world both by observationand by prediction of the way in which objects will behave. Concrete use of physical principles and analysis in various technical fields are given prominence in the course content to prepare students for various technical applications.

COURSE OUTCOMES

At the end ofthiscourse,thestudentswill beableto:

CO1: Differentiate between types of waves and their motion.

CO2: Illustrate laws of reflection and refraction of light.

CO3: Demonstrate competency in phenomena of electrostatics and electricity.

CO4: Characterize properties of material to prepare new materials for various technical applications.

CO5: Demonstrate strong foundation on Modern Physics to use at various technical applications.

DETAILED CONTENTS

UNIT I Wave Motion and its Applications

1.1 Waves: definition, types (mechanical and electromagnetic wave).

1.2 Wave motion- transverse and longitudinal with examples, terms used in wave motion like displacement, amplitude, time period, frequency, wave length, wave velocity; relationship among wave velocity, frequency and wave length.

1.3 Simple harmonic motion (SHM): definition, examples.

1.4 Cantilever: definition, formula of time period (without derivation).

1.5 Free, forced and resonant vibrations with examples.

1.6 Sound waves: types (infrasonic, audible, and ultrasonic) on the basis of frequency, noise, coefficient of absorption of sound, echo.

UNIT II Optics

2.1 Reflection and refraction of light with laws, refractive index.

2.2 Lens: introduction, lens formulae (no derivation), power of lens and simple numerical problems.

2.3 Total internal reflection and its applications, critical angle and conditions for total internal reflection.

2.4 Superposition of waves (concept only), definition of Interference, Diffraction and Polarization of waves.

2.5 Introduction to Microscope, Telescope and their applications.

UNIT III Electrostatics and Electricity

3.1 Electric charge, unit of charge, conservation of charge.

3.2 Coulomb ‘slaw of electrostatics.

3.3 Electric field, electric lines of force (definition and properties), electric field intensity due to appoint charge.

3.4 Definition of electric flux, Gauss law (statement and formula).

3.5 Capacitor and capacitance (with formula and unit).

3.6 Electric current and its SI Unit, direct and alternating current.

3.7 Resistance, conductance (definition and unit).

3.8 Series and parallel combination of resistances.

3.9 Ohm ‘slaw (statement and formula).

UNIT IV Classification of Materials and their Properties

4.1 Definition of energy level, energy bands.

4.2 Types of materials (conductor, semiconductor, insulator and dielectric) with examples, intrinsic and extrinsic semi conductors (introduction only).

4.3 Introduction to magnetism, type of magnetic materials: diamagnetic, paramagnetic and ferromagnetic materials with examples.

4.4 Magnetic field, magnetic lines of force, magnetic flux.

4.5 Electromagnetic induction (definition).

UNIT V Modern Physics

5.1 Laser: introduction, principle, absorption, spontaneous mission, stimulate demission, population in version.

5.2 Engineering and medical applications of laser.

5.3 Fiber optics**:** introduction to optical fibers (definition, principle and parts), light propagation, fiber types (mono-mode, multi-mode), applications in medical,

telecommunication and sensors.

5.4 Nanotechnology: introduction, definition of nano material's with examples, properties at nano scale, applications of nanotechnology (brief)

PRACTICAL EXERCISES

1. Familiarization with apparatus (resistor, rheostat, key, ammeter, voltmeter, telescope, microscope etc.)
2. To find the time period of a simple pendulum.
3. To study variation of time period of a simple pendulum with change in length of pendulum.
4. To determine and verify the time period of Cantilever.
5. To verify Ohm 'slaws by plotting a graph between voltage and current.
6. To study colour coding scheme of resistance.
7. To verify laws of resistances in series combination.
8. To verify laws of resistance in parallel combination.
9. To find resistance of galvanometer by half deflection method.
10. To verify laws of reflection of light using mirror.
11. To verify laws of refraction using glass lab.
12. To find the calling the of a concave lens, using a convex lens.

RECOMMENDED BOOKS

1. "Text Book of Physics for Class XII (Part-I, Part-II)", N.C.E.R.T., Delhi.
2. Dr. HH Lal."Applied Physics,Vol.I & II", TTTI Publications, Tata Mc Graw Hill, Delhi.
3. A S Vasudeva,"Applied Physics–II", Modern Publishers, Jalandhar.
4. RA Banwait,"Applied Physics–II", Eagle Prakashan, Jalandhar.
5. N Subrahmanyam, Brij Laland Avadhanulu,"A text book of OPTICS", S Chand Publishing, New Delhi.
6. E-books/e-tools/relevant software to be used as recommended by AICTE/HSBTE/NITTTR.
7. MH Fulekar,"Nanotechnology: Importance and Applications", IK International Publishing House (P) Ltd., New Delhi.
8. C.L. Arora, "Practical Physics", S Chand Publication.

SUGGESTED WEBSITES

1. http://swayam.gov.in

INSTRUCTIONAL STATREGY

This is hands-on practice based subject and topics taught in the class should be practiced in theLab regularly for development of required skills in the students.This subject contains five unitsof equal weight age. Teacher may use various teaching aids like models, charts, graphs and experimental kits etc. for imparting effective instructions in the subject. Students need to beexposed to use of different sets of units and conversion from one unit type to another. Softwaremay be used to solve problems involving conversion of units. The teacher should explain about field applications before teaching the basics of mechanics, work, power and energy, rotational motion, properties of matter etc. to develop proper understanding of the physical phenomenon.Use of demonstration can make the subject interesting and develop scientific tempering the students. Teachers should give examples of engineering/technology applications of various concepts and principles in each topic so that students are able to appreciate learning of these concepts and principles. In all contents, SI units should be followed. Working in different sets of units can be taught through relevant software.

2.4 FUNDAMENTALS OF ARTIFICIAL INTELLIGENCE

L	P
4	-

RATIONALE

Artificial Intelligence (AI) is one of the most sought-after technologies of the modern day. The main purpose of this course is to provide the most fundamental knowledge to the students so that they can understand what the AI is. AI is a research field that studies how to realize the intelligent human behaviors on a computer. The ultimate goal of AI is to make a computer that can learn, plan, and solve problems autonomously.

LEARNING OUTCOMES:

After having completed the course the student will be able to:

CO1: Give an overview of the field of artificial intelligence,

CO2: Interpret and formulate knowledge representations in the form of logic expressions

CO3: Explain basic concepts, methods and theories of neural networks and learning

CO4: Demonstrate the knowledge about Machine learning and its contrast with Deep Learning

CO5: Illustrate the concept of NLP and Computer vision

DETAILED CONTENTS

UNIT I
Intelligent Systems

1.1 Introduction to intelligence
1.2 Different types of intelligence
1.3 Elaborate between Human and Machine Intelligence
1.4 Background, and history of Artificial Intelligence
1.5 Main Goals of AI
1.6 Classification of AI
1.7 Knowledge Representation
1.8 Logic-Based Learning

UNIT II
Overview of AI

2.1 Philosophy of AI and AI Technique
2.2 Fundamental problems and challenges - realism, brittleness, scalability, real-time requirements, the frame problem, common-sense knowledge and common-sense reasoning.
2.3 Ethical and Society related implications, laws for AI in India, sharing of best practices.
2.4 Applications of AI:Transportation, home/service robots, healthcare, education, banking, entertainment, public safety and security.
2.5 Malicious Use of AI: Prevention and Mitigation:Security relevant properties of AI, Security domains and scenarios: digital security, physical security, political security, factors affecting the equilibrium of AI and security.
2.6

UNIT III
Artificial Neural Networks

3.1 Biological Neural Network-structure of human brain,
3.2 Characteristics of ANN, Artificial neurons,
3.3 Types of ANN-Single layer and multilayer, Feed forward and feedback NN
3.4 Activation functions: Linear and Non Linear activation functions
3.5 Training of ANN
3.6 Introduction to ANN applications

UNIT IV
Introduction to Machine Learning and Deep Learning

4.1 Introduction to Machine Learning,
4.2 Machine learning improvises AI ,
4.3 Supervised, Unsupervised, Semi-Supervised Learning and Reinforcement Learning,
4.4 Introduction to Deep Learning,
4.5 Difference between Deep Learning and Machine Learning,
4.6 Applications of ML and DL.

UNIT V
Introduction of NLP and Computer Vision

5.1 Introduction to Natural Language Processing,
5.2 Components of Natural Language Processing,

5.3 Steps of NLP,
5.4 Challenges of NLP,
5.5 Introduction to Computer Vision,
5.6 Applications of Computer Vision,
5.7 Computer Vision and its Relation to Natural Language Processing,
5.8 Future of Natural Language Processing and Computer Vision.

RECOMMENDED BOOKS

1. Sivanandam & Deepa“ Principles of Soft Computing” Wiley India.
2. V.K. Jain, Machine Learning, Khanna Publishing House
3. Vinod Chandra S.S., Artificial Intelligence & Machine Learning, PHI
4. Stuart Russell and Peter Norvig, ‘Artificial Intelligence: A Modern Approach, 4th US ed.
5. Artificial Intelligence and the Future of Power' by Rajiv Malhotra, Rupa Publications
6. An Introduction To Neural Networks, James A Anderson, MIT Press,

SUGGESTED WEBSITES

1. http://swayam.gov.in

INSTRUCTIONAL STATREGY

This is hands-on practice based subject and topics taught in the class should be practiced in the Lab regularly for development of required skills in the students. This subject contains five units of equal weight age.

2.5 WEB TECHNOLOGY

L	P
2	4

RATIONALE

This course is intended to teach the basics involved in publishing content on the World Wide Web. This includes the 'language of the Web' – HTML, the fundamentals of how the Internet and the Web function, a basic understanding of graphic production with a specific stress on creating graphics for the Web.

COURSE OUTCOMES

At theendofthecourse student willbe ableto

CO1: Analyze a web page and identify its elements and attributes

CO2: Create web pages using HTML and Cascading Style Sheets

CO3: Develop well-designed, interactive Website with respect to current standard and practices

CO4: Comprehend client and server-side scripting and their applicability

CO5: Illustrate the usage of Content Management Systems (CMS)

DETAILED CONTENTS

UNIT I

Introduction to Web Technology and Web Publishing

Internet and Its Applications, Web Protocols for Communications, Categories of Web Applications, Characteristics of Web Applications, TCP, UDP, Clients, Servers, and Communication. The Internet, Basic Internet Protocols, World Wide Web, HTTP request message, response message, Web Clients Web Servers, Case Study, Markup Languages in Web Publishing.

UNIT-II

Introduction to HTML

HTML: Basic Syntax, Standard HTML Document Structure, Basic Text Markup, Html styles, Elements, Attributes, Heading, Layouts, Html media, Frames Images, Hypertext Links, Lists, Tables, Forms, GET and POST method, HTML 5, Dynamic HTML

UNIT III

Style Sheets and Client Side SCRIPTING in HTML

Style sheets in Web Pages, Client Side Scripting Languages, CSS-Introduction to Cascading Style Sheets-Features-Core Syntax-Style Sheets and HTML Style Rule Cascading and Inheritance-Text Properties-Box Model Normal Flow Box Layout-Beyond the Normal Flow-Other Properties-Case Study. Client- Side Programming: The JavaScript Language-History and Versions Introduction JavaScript in Perspective-Syntax Variables and Data Types-Statements, Operators, Literals, Functions, Objects, Arrays, Built, in Objects, JavaScript Debuggers

UNIT IV

Content Management Systems

Content Management Systems (CMS), Use Cases and Implementation Scenarios of CMS Products, Free and Open Source CMS Suites, Working with Wordpress and Joomla, Creating Articles, Menus and Applications using Joomla, Developing and Publishing Web Applications using Wordpress and Joomla.

PRACTICAL EXERCISES

1. Internet and its Applications
    - Establishing an internet connection.
    - Browsing and down loading of information from internet.
    - Sending and receiving e-mail
    - Creating a message
    - Creating an address book
    - Attaching a file with e-mail message
    - Receiving a message
    - Deleting a message
    - Assigning IP Addresses to computers and use of domain names.

2. Creating an HTML document
    - Working with Mark up Tags
    - Working with Heading-Paragraphs
    - Working with Text
    - Working with Lists
    - Working with Tables and Frames
3. Working with Hyperlinks, Images and Multimedia.
4. Working with Forms and controls.
5. Create a HTML form with Name, Password and Confirm Password Write a Java script to validate if Password and Confirm Password field values are same.
6. Write a simple Java script program.
7. Write a Java script to illustrate auto refreshing in your own Web page.
8 Write a Java script to greet the user with “Good Morning” or “Good Afternoon” or “Good Evening”.
9. Install Word press.
10. Basic working of Joomla.

RECOMMENDED BOOKS

1. GertiKappel, Birgit Proll, “Web Engineering”, John Wiley and Sons Ltd, 2006.
2. Roger S. Pressman, David Lowe, “Web Engineering”, Tata McGraw Hill Publication, 2007.
3. Raj Kamal, “Internet and Web Technologies”, Tata McGraw-Hill
4. Nicholas C.Zakas, “Professional JavaScript for Web Developers”, Wrox- Wiley Dreamtech, 2005.
5. Thomas A.Powell, “HTML&XHTML –The Complete Reference”, Tata McGraw Hill,2006
6. JavaScript: The Definitive Guide-By David Flannagan, 2003.
7. Learn Content Management System in 24 Hrs, Build Website with Word press and Joomla by Roshan+Gunathilake.

SUGGESTED WEBSITES

1. https://nptel.ac.in/courses
2. https://nptel.ac.in/courses

INSTRUCTIONAL STRATEGY

This is a skill based subject and topics taught in the class should be practiced in the Lab regularly for development of required skills in the students. This subject contains four units of equal weight age.

2.6 ENVIRONMENTAL STUDIES AND DISASTER MANAGEMENT

L

P
2

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RATIONALE

A diploma holder must have knowledge of different types of pollution caused due to industrial and construction activities so that he/she may help in balancing the ecosystem and controlling pollution by various control measures. The course is intended to provide a general concept inthe dimensions of environmental pollution and disasters caused by nature beyond the human control as well as the disasters and environmental hazards induced by human activities with emphasis on disaster preparedness, response and recovery.

COURSE OUTCOMES

After undergoing the subject, the student will be able to:

CO1: Comprehend the importance of sustainable ecosystem.

CO2: Demonstrate interdisciplinary nature of environmental issues.

CO3: Implement corrective measures forth abatement of pollution.

CO4: Identify the role of non-conventional energy resources in environmental protection.

CO5: Manage various types of disasters.

DETAILED CONTENTS

UNIT I
Introduction

1.1 Basics of ecology, ecosystem-concept, and sustainable development, Sources, advantages, disadvantages of renewable and nonrenewable energy.

1.2 Rain water harvesting.

1.3 Deforestation–its effects & control measures.

UNIT II
Air and Noise Pollution

2.1 Air Pollution: Source of air pollution. Effect of air pollution on human health, economy, Air pollution control methods.

2.2 Noise Pollution: Source of noise pollution, Unit of noise, Effect of noise pollution, Acceptable noise level, Different method of minimizing noise pollution.

UNIT III
Water and Soil Pollution

3.1 Water Pollution: Impurities in water, Cause of water pollution, Source of water pollution. Effect of water pollution on human health, Concept of DO, BOD, COD. Prevention of water pollution- Water treatment processes, Sewage treatment. Water quality standard.

3.2 Soil Pollution: Sources of soil pollution, Effects and Control of soil pollution, Types of Solid waste- House hold, Industrial, Agricultural, Biomedical, Disposal of solid waste, Solid waste management E-waste, E–waste management.

UNIT IV
Impact of Energy Usage on Environment

Global Warming, Green House Effect, Depletion of Ozone Layer, Acid Rain. Eco-friendly Material, Recycling of Material, Concept of Green Buildings, Concept of Carbon Credit & Carbon footprint.

UNIT V
Disaster Management

A. Different Types of Disaster: Natural Disaster: such as Flood, Cyclone, Earth quakes and Landslides etc.
Man-made Disaster: such as Fire, Industrial Pollution, Nuclear Disaster, Biological Disasters, Accidents (Air, Sea Rail & Road), Structural failures (Building and Bridge),War & Terrorism etc.

B. Disaster Preparedness: Disaster Preparedness Plan Prediction, Early Warnings and Safety Measures of Disaster Psychological response and Management (Trauma, Stress, Rum our and Panic)

RECOMMENDED BOOKS

1. Environmental Studies by S.C. Sharma & M.P. Poonia, Khanna Publishing House, New Delhi
2. Environmental and Pollution Awareness by Sharma BR; Satya Prakashan, New Delhi.
3. Environmental Pollution by Dr. RKK hitoliya; S Chand Publishing, New Delhi.
4. Environmental Studies by Erach Bharucha; University Press (India) Private Ltd., Hyderabad.
5. Environmental Engineering and Management by Suresh K Dhamija; S K Kataria and Sons,NewDelhi.
6. E-books/e-tools/relevant of ware to be used are commended by AICTE/BTE/NITTTR, Chandigarh.
7. Disaster Management by Dr. Mrinalini Pandey, Wiley India Pvt. Ltd.
8. Disaster Science and Management by Tushar Bhattacharya, McGraw Hill Education (India) Pvt.Ltd.

INSTRUCTIONAL STRATEGY

In addition to theoretical instructions, different activities pertaining to Environmental Studies and Disaster Management like expert lectures, seminars, visits etc. may also be organized This subject contains five units of equal weight age.

SECOND YEAR

NSQF LEVEL - 4

12. STUDY AND EVALUATION SCHEME

THIRD SEMESTER

Sr. No.	SUBJECTS	STUDY SCHEME Periods/Week		Credits L+P=C	MARKS IN EVALUATION SCHEME						Total Marksof Internal & External
					INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT			
		L	P		Th	Pr	Total	Th	Pr	Total	
3.1	Industrial/In-HouseTraining-I	-	2	**0+1=1**	-	40	40	-	60	60	100
3.2	Digital Electronics & Microcontrollers	3	4	**3+2=5**	40	40	80	60	60	120	200
3.3	Neural Networks	3	-	**3+0=3**	40	-	40	60	-	60	100
3.4	Data Science using Python	2	6	**2+3=5**	40	40	80	60	60	120	200
3.5	JAVA Technologies	3	6	**3+3=6**	40	40	80	60	60	120	200
3.6	OpenElective(MOOCs^{+}/Offline)	2	-	**2+0=2**	40	-	40	60	-	60	100
#Student Centered Activities (SCA)		-	4	-	-	-	-	-	-	-	-
Total		**13**	**22**	**22**	**200**	**160**	**360**	**300**	**240**	**540**	**900**

+ Assessment of Open Elective through MOOCs shall be based on assignments out of 100marks.

#Student Centered Activities will comprise of co-curricular activities like extension lectures on Constitution of India, Electoral Literacy, Motor Vehicles (Driving) Regulations 2017etc., games, hobby clubs e.g. photography etc., seminars, declamationcontests,educational field visits, N.C.C., NSS, Cultural Activities andself-studyetc.

FOURTH SEMESTER

Sr. No.	SUBJECTS	STUDYS CHEME Periods/Week		Credits (C)L+ P= C	MARKS IN EVALUATION SCHEME						Total Marks of Internal & External
					INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT			
		L	P		Th	Pr	Total	Th	Pr	Total	
4.1	*English and Communication Skills -II	2	2	**2+1=3**	40	40	80	60	60	120	200
4.2	Machine Learning	3	4	**3+2=5**	40	40	80	60	60	120	200
4.3	Algorithm Design Techniques	2	4	**2+2=4**	40	40	80	60	60	120	200
4.4	Internet of Things	2	4	**2+2=4**	40	40	80	60	60	120	200
4.5	Programme Elective-**I**	2	2	**2+1=3**	40	40	80	60	60	120	200
4.6	Minor Project	-	6	**0+3=3**	-	40	40	-	60	60	100
#Student Centered Activities(SCA)		-	2	-	-	-	-	-	-	-	-
Total		**11**	**24**	**22**	**200**	**240**	**440**	**300**	**360**	**660**	**1100**

* Common with other diploma programmes

Programme Elective-I 4.5.1Cloud Computing 4.5.2 Linux & Its Application 4.5.3 Embedded System & Design

#Student Centered Activities will comprise of co-curricular activities like extension lectures on Constitution of India, Electoral Literacy, Motor Vehicles (Driving) Regulations 2017etc., games, hobby clubs e.g. photography etc., seminars, declamation contests, educational field visits, N.C.C., NSS, Cultural Activities and self-study etc.

Industrial Training: After 4th Semester, students shall undergo Industrial Training of 4 Week.

13.HORIZONTAL AND VERTICAL SUBJECTS ORGANISATION

Sr. No.	Subject/Areas	Third Semester	Fourth Semester
1.	Industrial/In-HouseTraining- I	2	-
2.	Digital Electronics & Microcontrollers	7	-
3.	Neural Network	3	-
4.	Data Science using Python	8	-
5.	JAVA Technologies	9	-
6.	Open Elective (MOOCs/Offline)	2	-
7.	English and Communication Skills - II	-	4
8.	Machine Learning	-	7
9.	Algorithm Design Techniques	-	6
10.	Internet of Things	-	6
11.	Programme Elective-**I**	-	4
12	Minor Project		6
13.	Student Centered Activities	4	2
	Total	**35**	**35**

14.COMPETENCY PROFILE & EMPLOYMENT OPPORTUNITIES

Government and private sectors related to **Artificial Intelligence & Machine Learning require skilled workers** to work in familiar, predictable, routine situations of clear choice. They are expected to havefactual knowledge of AI field. They shall be able to write and speak withrequired clarity. Students after passing level 4 shall have understanding of basic arithmetic, algebraic principles along with basic understanding of social and natural environment. They areexpected to recall and demonstrate quality skill in narrow range of applications using appropriaterulesand tools.

With the rapid technological developments in the field, artificial intelligence is one of the most sought after skills by large technology companies. With many forecasters deeming that computers will take over many manufacturing jobs, programming artificial intelligence is a job for the future. Below are some examples of jobs common for skilled professionals with knowledge in artificial intelligence, robotics, machine learning, and related fields, including a brief job description of each role.

Skilled workers will be responsible for carrying out a range of jobs, some of which will requirethem to make choices about the approaches they adopt. They will be expected to learn andimprove their practice on the job. They should know what constitutes quality in the occupationand should distinguish between good and bad quality in the context of their job roles. Skilledworker at this level will be expected to carry out their work safely and securely and take fullaccountofthehealthandsafetyoncolleaguesandcustomers.Theyshouldworkhygienicallyand in ways which show an understanding of environmental issues. In working with others, theywill be expected to conduct themselves in ways which show a basic understanding of the socialandpolitical environment.

NSQF Level – 4 pass out students are expected have need to have a strong understanding of requirements of a AI/ML problem and find the solution to them using computing principles. They should be able to Create and evaluate a computer-based AI/ML model, components and process to meet the specific needs of applications and develop and integrate effectively AI/ML based components into user environment.

With the rapid technological developments in the field, artificial intelligence is one of the most sought after skills by large technology companies. With many forecasters deeming that computers will take over many manufacturing jobs, programming artificial intelligence is a job for the future. Below are some examples of jobs common for skilled professionals with knowledge in artificial intelligence, robotics, machine learning, and related fields, including a brief job description of each role.

With a diploma in AI, there are several employment opportunities available, including:
Machine Learning Engineer, Data Scientist, AI Developer, AI Product Manager.

15.PROGRAMME OUTCOMES

The program outcomes are derived from five domains of NSQF Level – 4 namely Process, Professional Knowledge, Professional Skill, Core Skill, Responsibility. After completing thislevel,the student will be able to:

PO1: Perform out task in familiar, predictable, routine situation of clear choice.

PO2: Acquire factual knowledge in the field of Artificial Intelligence & Machine Learning **F**or employment.

PO3: Demonstratean understanding of advanced knowledge of the practice of Artificialintelligence and machine learninginroutineand repetitiveinnarrowrange

PO4: Communicate in writing and speaking with required clarity and demonstrate Professional behavior.

PO5: Adopt self-study learning and acquire knowledge aiming towards holistic development of learners through MOOCs.

16.ASSESSMENT OF PROGRAMME AND COURSE OUTCOMES

Programme Outcomes to be assessed	Assessment criteria for the Course Outcomes
PO1: Perform out task in familiar, predictable, routine situation of clear choice.	• Takenecessarysafetyprecautions and measures. • Learn about present and future requirement of industries. • Work in team for solving industrial problems. • Develop required competencies and skills for relevant industries. • Comprehend the importance of digitization. • Perform the analysis and design of various digital electronic circuits. • Understand the working of microcontrollers • Comprehend basicsof ANNandapplicationsofANN • Describehow machines learn through learning algorithms. • Illustratelogicbehindsupervisedandunsupervised networks • Comprehend various Python data types, control structures, features • Performin a better wayintheprofessionalworld. • Identify present and future requirements of relevant industries. • Discuss the fundamentals of algorithm. • Comprehend the concept of Internet of Things and its applications • Identify present and future requirements of relevant industries. • Work as a team member for successful completion of minor project.

PO2: Acquire factualknowledge Inthefieldof Artificial Intelligence & Machine Learningfor employment.	• Comprehend the importance of digitization. • Apply the knowledge to understand digital electronics circuits. • Understand the working of microcontrollers • Comprehend basics of ANN and applications of ANN • Describehow machines learn through learning algorithms. • Illustratelogicbehindsupervisedandunsupervised networks • Apply logic of ANN for real life applications • Comprehend various Python data types, control structures, features • State the basic concepts and principles about the subject of interest. • Explain various Service and Deployment Models • Illustrate the fundamental concepts of cloud storage apply the concept of virtualization. • Discuss the fundamentals of algorithm. • Describe the analysis of algorithm efficiency using different notations. • Comprehend the concept of Internet of Things and its applications • Understand and analyse sensor generated data • Interface basic sensors with microcontrollers. • Explore the potential applications of IoT in various industries • Learning of fundamental of Linux operating System. • Describe embedded system • Explain embedded operating systems • Interface sensors with microcontroller • Repair microcontroller based appliances

PO3: Demonstrate an understanding of advanced knowledge of the practice of Artificial intelligence and machine learning in routine and repetitive in narrow range.	• Learn about present and future requirement of industries. • Develop required competencies and skills for relevant industries. • Perform the analysis and design of various digital electronic circuits. • Apply the knowledge to understand digital electronics circuits. • Apply logic of ANN for real life applications • Comprehend various Python data types, control structures, features • Utilize core programming tools such as functions and loops. • Apply widely used python packages into data analytics. • Empowering students with tools and techniques used in data science • Exercise debugging, compiling and executing Java Programs • Implement Polymorphism and Inheritance using Java • Analyzing threads, Multi-threading and Applets in Java • Apply the basic features of Python language to machine learning tasks. • Prepare plots such as bar plot, histogram, distribution plot, box plot, scatter plot, pair plot, and heat maps to find insights. • Illustrate simple and multiple linear regression and its applications in predictive analysis. • Explain core concepts of cloud computing paradigm. • Explain various Service and Deployment Models • Describe SLA management in Cloud Computing

	• Illustrate the fundamental concepts of cloud storage apply the concept of virtualization. • Illustrate various problems using Brute force and Divide and-Conquer Technique. • Apply Analysis Framework • Comprehend the concept of Internet of Things and its applications • Interface basic sensors with microcontrollers. • Explore the potential applications of IoT in various industries • Learning of fundamental of Linux operating System. • Exploring Linux file system with basic and advanced commands. • Working with Shell scripting and regular expressions. • Analyzing the programming behavior based on programming development and management on Linux Systems. • Developing creativity as system administrative with networking expertise in Linux Systems. • Program PIC microcontroller and AVR microcontroller • Interface sensors with microcontroller • Repair microcontroller based appliances

PO4: Communicate in writing and speaking withrequiredclarityand demonstrateProfessional behavior.	• Comprehend the working environment of industries. • Work in team for solving industrial problems. • Develop required competencies and skills for relevant industries. • Develop required competencies for effective communication and presentation. • Performin a better wayintheprofessionalworld. • Developthehabitofself-learningthroughonlinecourses. • Communicate effectively with an increased confidence; read, write and speak in English language fluently. • Comprehend special features of format and style of formal communication through various modes. • Write a Report, Resume, make a Presentation, Participate in GDs and Face Interviews • Illustrate use of communication to build a positive self-image through self-expression and develop more productive interpersonal relationships. • Comprehend the importance of digitization. • Empowering students with tools and techniques used in data science • Select and learn the subject related to own interest. • Identify present and future requirements of relevant industries. • Work as a team member for successful completion of minor project. • Acquire Life Long Learning skills. • Create writing and communication skills. • Develop Presentation skills.

PO5: Adopt self-study learning and acquire knowledge aiming towards holisticdevelopment of learners through MOOCs.	• Work in team for solving industrial problems. • Develop required competencies and skills for relevant industries. • Develop required competencies for effective communication and presentation. • State the basic concepts and principles about the subject of interest. • Performin a better wayintheprofessionalworld. • Select and learn the subject related to own interest. • Explorelatestdevelopments inthe fieldof interest. • Developthehabitofself-learningthroughonlinecourses. • Communicate effectively with an increased confidence; read, write and speak in English language fluently. • Comprehend special features of format and style of formal communication through various modes. • Illustrate use of communication to build a positive self-image through self-expression and develop more productive interpersonal relationships. • Identify the various resources / sources and / or schemes for starting a new venture. • Work as a team member for successful completion of minor project. • Acquire Life Long Learning skills. • Write the minor project report effectively and present through ppt.

17. SUBJECTS & CONTENTS

(SECOND YEAR)

THIRD SEMESTER

3.1 INDUSTRIAL/IN-HOUSE TRAINING - I

L	P
-	2

RATIONALE

Industrial training / In – house training will help the students to understand the working environment of relevant industries. The student will learn to work in team to solve the industrial problems. It will also give exposure about the present and future requirements of the relevant industries. This training is very important for development of required competencies and skills for employment and start – ups.

COURSE OUTCOMES

After undergoing the subject, the students will be able to:

CO1: Understand the working environment of industries.

CO2: Take necessary safety precautions and measures.

CO3: Learn about present and future requirement of industries.

CO4: Work in team for solving industrial problems.

CO5: Develop competencies and skills required by relevant industries.

CO6: Develop writing, speaking and presentations skills.

PRACTICAL EXERCISES

1. Report writing based on industrial training.
2. Preparation of Power Point Slides based on industrial training and presentation by the candidate.
3. Internal Evaluation based on quality of Report, PPT preparation, PPT presentation and answer to queries.
4. External Evaluation based on quality of Report, PPT preparation, PPT presentation and answer to queries.

GUIDELINES

Students will be evaluated based on Industrial training / In – house training report and their presentation using Power Point about the knowledge and skills gained during the training. The Head of the Department will depute faculty coordinators by assigning a group of students to each. The coordinators will mentor and guide the students in preparing the PPTs for final presentation. The following performance parameters are to be considered for assessment of the students out of 100 marks:

	Parameter	**Weightage**
i	Industrial / In-house assessment of the candidate by the trainer	40%
ii	Report Writing	20%
iii	Power Point Presentation	20%
iv	Viva-voce	20%

3.2 DIGITAL ELECTRONICS & MICROCONTROLLERS

L	P
3	4

RATIONALE

This course has been designed to make the students know about the fundamental principles of digital electronics and gain familiarity with the available IC chips. This subject aims to give a background in the broad field of digital systems design, microprocessors and microcontroller. The study of microcontrollers in terms of architecture, software and interfacing techniques leads to the understanding of working of microcontrollers and applications of microcontroller in Electronic Industries.

COURSE OUTCOMES

After undergoing this course, the students will be able to:

CO1: Comprehend the importance of digitization.

CO2: Perform the analysis and design of various digital electronic circuits.

CO3: Apply the knowledge to understand digital electronics circuits.

CO4: Understand the working of microcontrollers

DETAILED CONTENTS

UNIT I

Number System

1.1 Distinction between analog and digital signal, Applications and advantages of digital signals

1.2 Binary, octal and hexadecimal number system: conversion from decimal and hexadecimal to binary and vice-versa.

1.3 Binary addition and subtraction including binary points. 1's and 2's complement method of addition/subtraction.

UNIT II

Logic Gates & Simplification

2.1 Negative and Positive logic

2.2 Definition, symbols and truth tables of NOT, AND, OR, NAND, NOR, EXOR Gates, NAND and NOR as universal gates

2.3 Boolean algebra, De Morgan's Theorems. Implementation of Boolean (logic) equation with gates

2.4 Karnaugh map (upto 4 variables)

UNIT III

Combinational circuits

3.1 Half adder and Full adder circuit, design and implementation.

3.2 MUX and DEMUX

3.3 Decoder and 7 segment display

3.4 Encoder

UNIT IV

Sequential circuits

4.1 Latch and flip flop

4.2 Difference between latch and flip flops

4.3 Working with truth tables of RS, JK, T, D, Master/Slave JK flip flops.

4.4 Shift registers Shift left, shift right and rotate operation

4.5 SISO, SIPO, PISO, PIPO

4.6 Asynchronous and Synchronous counters

UNIT V

Microcontroller 8051 Overview

5.1 Architecture of 8051Microcontroller

5.2 Pin details

5.3 I/O Port structure

5.4 Memory Organization

5.5 Special Function Registers (SFRs)

5.6 External Memory

PRACTICAL EXERCISES

1. Verification and interpretation of truth tables for AND, OR, NOT.
2. NAND, NOR and Exclusive OR (EXOR) and Exclusive NOR(EXNOR) gates.
3. (a) Realization of logic functions with the help of NAND or NOR gates
   (b) To design a half adder using XOR and NAND gates and verification of its operation
4. Construction of a full adder circuit using XOR and NAND gates and verify its operation
5. (a) Verification of truth table for positive edge triggered, negative edge triggered, level triggered IC flip-flops (At least one IC each of D latch , D flip-flop, JK flip-flops).
   (b) Verification of truth table for encoder and decoder ICs, Mux and DeMux
6. MUX and DEMUX
   (a) To design a 4 bit SISO, SIPO, PISO, PIPO shift registers using JK/D flip flops and verification of their operation.
   (b) To design a 4 bit ring counter and verify its operation.
   (c) Use of Asynchronous Counter ICs (7490 or 7493)
7. Familiarization with 8051 Micro-controller Kit and its different sections
8. Write a program to interface Seven Segment Display with 8051.
9. Write a program to interface LCD with 8051.
10. Write a program for Traffic light Control using 8051.
11. Write a program for Elevator Control using 8051.
12. Simulators Based Experiments

RECOMMENDED BOOKS

1. Morris Mano, “Digital Logic Designs”, Prentice Hall of India, New Delhi.
2. RP Jain, “Digital Electronics”, Tata McGraw Hill Education Pvt. Ltd., New Delhi.
3. KS Jamwal, “Digital Electronics”, Dhanpat Rai and Co., New Delhi.
4. Sanjeev Gupta, “Microcotroller”, Ishan Publication.

SUGGESTED WEBSITES

1. http://nptel.ac.in
2. https://ekumbh.aicte-india.org
3. http://swayam.gov.in

INSTRUCTIONAL STRATEGY

Teacher should lay-emphasis on development of understanding amongst students about basic principles. This may be achieved by conducting quiz tests and by giving home assignments. The teachers should also conduct laboratories classes themselves encouraging each should to perform with his/her own hands and draw conclusions. This is practice based subject and topics taught in the class should be practiced in the Lab regularly for development of required communication skills in the students. This subject contains five units of equal weight age.

3.3 NEURAL NETWORKS

L	P
3	-

RATIONALE

Contents of this course provide fundamental base for understanding of neural networks. Contents of this course will enable students to use basic knowledge of learning, terminologies, basic difference between neural networks and human brain. The students should have clear idea about the upcoming field of neural networks which will be a foundation course for the advance courses in the coming semesters.

COURSE OUTCOMES

After undergoing this course, the students will be able to:

CO1: Comprehend basics of ANN and applications of ANN
CO2: Describe how machines learn through learning algorithms.
CO3: Illustrate logic behind supervised and unsupervised networks
CO4: Apply logic of ANN for real life applications

DETAILED CONTENTS

UNIT I

Introduction to Neural Networks

Definition of neural networks, advantages of neural networks, scope of neural networks, fundamental concept of Artificial neural network and biological networks, comparison between artificial and biological neural networks, evolution of neural networks, basic model of neural networks, connections, type of learnings- supervised, unsupervised and reinforcement learning-theory.

UNIT II

Models of ANN and Learning Rules

Basic Models of Neural networks- Feedback and Feed forward neural networks, basic terminologies of ANN- threshold, weight, bias, learning rate, Mc-Culloh Pits neuron, learning rules for ANN- perceptron learning rule, delta learning rule, Hebbian learning rule, Outstar Learning Rule, Summary of Learning Rules.

UNIT III

Supervised Networks

Single layer perceptron network- perceptron learning rule use, architecture and training process, perceptron training algorithms for single output classes and multiple output classes, Adaptive linear neuron-theory, architecture, delta rule and training process.

UNIT IV

Multiple Adaptive Linear Neuron and Back Propagation Networks

Multiple Adaptive linear neuron-theory, architecture, training process, back propagation networks-architecture, training process and learning factors, Comparison between Adaptive linear Neuron and Multiple Adaptive Linear Neuron and Back Propagation Networks

UNIT V

Applications of Neural Systems

Character Recognition Networks -Recognition Based on Handwritten Character Skeletonization Recognition of Handwritten Characters Based on Error Neural Networks Control Applications Overview of Control Systems Concepts, Process Identification Networks for Robot Kinematics Overview of Robot Kinematics Problems Connectionist Expert Systems for Medical Diagnosis

RECOMMENDED BOOKS

1. Jacek M. Zurada, “Introduction to Artificial Neural Systems”, Jaico Publ. House.
2. T .N. Shankar, “Neural Network”, University Science Press.
3. V.K. Lamba, “Neuro Fuzzy Systems”, University Science Press.
4. Dr. S.N Sivanandnam and Dr. S. N Deepa, “Principles Soft Computing”, Wiley.

SUGGESTED WEBSITES

1. http://nptel.ac.in
2. http://swayam.gov.in

INSTRUCTIONAL STRATEGY

Teacher should lay-emphasis on development of understanding amongst students about basic principles. This may be achieved by conducting quiz tests and by giving home assignments... This subject contains five units of equal weight age.

3.4 DATA SCIENCE USING PYTHON

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2	6

RATIONALE

Data Science uses advanced machine learning algorithms and other scientific and digital methods to make this data useful. Data Science enables companies to efficiently understand gigantic data from multiple sources and derive valuable insights to make smarter data-driven decisions. Data Science is widely used in various industry domains, including marketing, healthcare, finance, banking, policy work, and more.

COURSE OUTCOMES

After undergoing this course, the students will be able to:

CO1: Comprehend various Python data types, control structures, features
CO2: Utilize core programming tools such as functions and loops.
CO3: Apply widely used python packages into data analytics.
CO4: Empowering students with tools and techniques used in data science

DETAILED CONTENTS

UNIT I

Python Program Execution Procedure – Statements – Expressions – Flow of Controls – Functions – Numeric Data Types – Sequences – Strings – Tuples – Lists – Dictionaries. Class – Constructors – Object Creation – Inheritance – Overloading. Text Files and Binary Files – Reading and Writing.

UNIT II

Toolboxes: Python, fundamental libraries for data Scientists. Integrated development environment (IDE). Data operations: Reading, selecting, filtering, manipulating, sorting, grouping, rearranging, ranking, and plotting.

Numpy and Pandas Packages Num Pyndarray - Vectorization Operation - Array Indexing and Slicing - Transposing Array and Swapping Axes - Saving and Loading Array - Universal Functions - Mathematical and Statistical Functions in Numpy.

UNIT III

Series and Data Frame data structures in pandas - Creation of Data Frames – Accessing the columns in a Data Frame - Accessing the rows in a Data Frame - Panda's Index Objects - Reindexing Series and Data Frames - Dropping entries from Series and Data Frames - Indexing, Selection and Filtering in Series and Data Frames - Arithmetic Operations between Data Frames and Series - Function Application and Mapping.

UNIT IV

Introduction to Data Science, Evolution of Data Science, Data Science Roles, Stages in a Data Science Project, Applications of Data Science in various fields, Data Security Issues.

Data Wrangling Combining and Merging Data Sets – Reshaping and Pivoting – Data Transformation – String manipulations – Regular Expressions.

PRACTICAL EXERCISES

1. Editing and executing Programs involving Flow Controls.
2. Editing and executing Programs involving Functions.
3. Interactive commands in Python, data operations, simple programs for writing into files and reading from files. Data file manipulations programs.
4. Familiarization with IDE in Python.
5. Writing programs for standard algorithms of sorting and searching in Python.
6. Plotting the data using X-Y graph, Bar- chart, and using other plotting techniques.
7. Plotting the various distributions for given data sets.
8. Classifying and presentation of data using support vector machine.
9. Write programs for k-means clustering and presentation for given data sets.
10. Write programs on graphs of social networks for community detection
11. Write programs for analysis of graphs to find centrality and page-rank.

RECOMMENDED BOOKS

1. L Igual, and Seghi, "Introduction to Data Science a Python approach to Concepts, Techniques and Applications", S. Springer.
2. David Taieb, "Data Analysis with Python A Modern Approach".
3. Armando Fandango, "Python Data Analysis".

SUGGESTED WEBSITES

1. http://nptel.ac.in
2. https://ekumbh.aicte-india.org
3. http://swayam.gov.in

INSTRUCTIONAL STRATEGY

Teacher should lay-emphasis on development of understanding amongst students about basic principles. This may be achieved by conducting quiz tests and by giving home assignments. The teachers should also conduct laboratories classes themselves encouraging each should to perform with his/her own hands and draw conclusions. This is practice based subject and topics taught in the class should be practiced in the Lab regularly for development of required communication skills in the students. This subject contains four units of equal weight age.

3.5 JAVA TECHNOLOGIES

L	P
3	6

RATIONALE

One of the essential reasons for Java's popularity is the cross-platform compatible and built-in security. Java program can run on any machine with a Java Runtime Environment (JRE) installed. Programs operate on various computers. Java is used by many banks, manufacturers, insurance organizations, utilities, and retailers. It is the reason that major industries ruled by Java. Java has shifted the programming paradigm of single machine to distributed network of machines. Any application on World Wide Web can be easily implemented. This course will enable the students to learn in detail network programming language Java.

COURSE OUTCOMES

After undergoing this course, the students will be able to:

CO1: Detail fundamental concepts of Object Oriented in Java
CO2: Exercise debugging, compiling and executing Java Programs
CO3: Implement Polymorphism and Inheritance using Java
CO4: Analyzing threads, Multi-threading and Applets in Java

DETAILED CONTENTS

UNIT I

Introduction to Java

Concept of OOPS, History of Java, how Java works, Java Virtual Machine(JVM), Java In Time(JIT) compiler, Java features, Java application types. Data types, Operators, If Statements, Switch Statement, Loops, Arrays, casting, command line arguments.

UNIT II

Java Classes and Memory Management

Introduction to Classes, objects, Constructors, inheritance (Single, Multilevel, Hybrid), Abstraction, encapsulation, polymorphism, finalizes, garbage collection, access specifier, Java interface, Packages.

UNIT III

Exception Handling and Stream Files

Overview of exception handling, Use of try & Catch block, method available to exceptions (The throw statement, the throws class, finally class), creating your own exception classes

UNIT IV

Threads and Multi-threading

Thread basics –creating and running a thread, thread control methods,
Threads life cycle and synchronization

UNIT V

Introduction to Applet and JDK

Building application with JDK, building applets with JDK

PRACTICAL EXERCISES

1. Write a program to print Hello Java
2. Write a program to convert the given temperature in Fahrenheit to Celsius using following conversion formula C= F.32/1.8
3. Write a program to find sum of digits
4. Display the output which is given below:

   *

   **

   ***
5. Admission to a professional course is subject to the following conditions:

   Marks in mathematics>=60

   Marks in physics>=50

   Marks in chemistry>=40

   Total in all 3subjects>=200(OR)

   Total in mathematics and physics>=150 given the marks in the 3 subjects.
   Write the program to check whether the application is eligible or not
6. Write a program to print Fibonacci Series
7. Write a program to print factorial of a number

8. Write a program to print reverse of a number
9. Write a program to check the number is Armstrong or not
10. Write a program to print prime numbers upto 100
11. Exercise on implementing Java Classes.
12. Write a program to implement the use of Constructors
13. Write a program to implement the use of Single Inheritance
14. Write a program to implement the use of Multilevel Inheritance
15. Write a program to implement the use of Hybrid Inheritance
16. Write a program to implement the use of Absract Classes
17. Write a program to implement Interfaces
18. Write a program to implement Package
19. Write a program to implement the use of Exception handling
20. Write a program to create and run threads
21. Write a program to draw the following using Applet:

RECOMMENDED BOOKS

1. Balagurusamy, " Java Programming", Tata McGraw Hill Education Pvt Ltd, New Delhi
2. Junaid Khateeb, "Computer Programming in Java," Wiley-India Pvt Ltd.
3. Patrick Naughton, " The Complete Reference" Tata McGraw Hill Education Pvt Ltd,.

SUGGESTED WEBSITES

1. http://nptel.ac.in
2. https://ekumbh.aicte-india.org
3. http://swayam.gov.in

INSTRUCTIONAL STRATEGY

Teacher should lay-emphasis on development of understanding amongst students about basic principles. This may be achieved by conducting quiz tests and by giving home assignments. The teachers should also conduct laboratories classes themselves encouraging each should to perform with his/her own hands and draw conclusions. This is practice based subject and topics taught in the class should be practiced in the Lab regularly for development of required communication skills in the students. This subject contains five units of equal weight age.

3.6 OPEN ELECTIVE

L	P
2	-

RATIONALE

Open electives are very important and play major role in implementation of National Education Policy. These subjects provide greater autonomy to the students in the curriculum, giving them the opportunity to customize it to reflect their passions and interests. The system of open electives also encourages cross learning, as students pick and choose subjects from the differentstreams.

COURSE OUTCOMES

At the end of the open elective, the students will be able to:

CO1: State the basic concepts and principles about the subject of interest.
CO2: Perform in a better way in the professional world.
CO3: Select and learn the subject related to own interest.
CO4: Explore latest developments in the field of interest.
CO5: Develop the habit of self-learning through online courses.

LIST OF OPEN ELECTIVES

(The list is indicative and not exhaustive)

1. mputer Application in Business
2. Introduction to NGO Management
3. Basics of Event Management
4. Event Planning
5. Administrative Law
6. Introduction to Advertising
7. Moodle Learning Management System
8. Linux Operating System
9. E-Commerce Technologies
10. NCC
11. Marketing and Sales
12. Graphics and Animations
13. Digital Marketing
14. Human Resource Management
15. Supply Chain Management
16. TQM

GUIDELINES

Open Elective shall be offered preferably in online mode. Online mode open elective shall preferably be through Massive Open Online Courses (MOOCs) from Swayam, NPTEL, Upgrad, Udemy, KhanAcademy or any other online portal to promote self-learning. A flexible basket of large number of open electives is suggested which can be modified depending upon the availability of courses at suggested portals and requirements. For online open electives, department coordinators shall be assigned to monitor and guide the group of students for selection of minimum 20 hours duration online course of their choice. For offline open electives, a suitable relevant subject shall be offered by the respective department to the students with minimum 40% of the total class strength as per present and future requirements.

Assessment of MOOCs open elective shall be based on continuous evaluation by the respective coordinator. The coordinator shall consider the submitted assignments by the students from time to time during the conduct of MOOCs. The MOOCs assessment shall be conducted by the coordinator along with one external expert by considering submitted assignments out of 100 marks.

In case, no suitable open elective is available online, only then the course may be conducted in offline mode. The assessment of offline open elective shall be internal and external. The offline open elective internal assessment of 40 marks shall be based on internal sessional tests; assignments etc. and external assessment of 60 marks shall be based on external examination at institute level.

SUGGESTED WEBSITES

1. https://swayam.gov.in/
2. https://www.udemy.com/
3. https://www.upgrad.com/
4. https://www.khanacademy.org/

FOURTH SEMESTER

4.1 ENGLISH AND COMMUNICATION SKILL - II

L	P
2	2

RATIONALE

Communication II moves a step further from Communication Skills I and is aimed at enhancing the linguistic competency of the students. Language as the most commonly used medium of self-expression remains indispensable in all spheres of human life – personal, social and professional. This course is intended to make fresh ground in teaching of Communicative English as per the requirements of National Skill Quality Framework.

COURSE OUTCOMES

After undergoing this course, the learners will be able to:

CO1: Communicate effectively with an increased confidence; read, write and speak in English language fluently.

CO2: Comprehend special features of format and style of formal communication through various modes.

CO3: Write a Report, Resume, make a Presentation, Participate in GDs and Face Interviews

CO4: Illustrate use of communication to build a positive self-image through self-expression and develop more productive interpersonal relationships.

DETAILED CONTENTS

UNIT I Reading

1.1 Portrait of a Lady - Khushwant Singh

1.2 The Doctor’s Word by R K Narayan

1.3 Speech by Dr Kiran Bedi at IIM Indore2007 Leadership Concepts

1.4 The Bet - by Anton Chekov

UNIT II Effective Communication Skills

2.1 Modern means of Communication (Video Conferencing, e- mail, Teleconferencing)

2.2 Effective Communication Skills: 7 C’s of Communication

2.3 Non-verbal Communication – Significance, Types and Techniques for Effective Communication
2.4 Barriers and Effectiveness in Listening Skills
2.5 Barriers and Effectiveness in Speaking Skills

Unit III Professional Writing

3.1 Correspondence: Enquiry letters, placing orders, complaint letters
3.2 Report Writing
3.3 Memos
3.4 Circulars
3.5 Press Release
3.6 Inspection Notes and tips for Note-taking
3.7 Corrigendum writing
3.8 Cover Letter

UNIT IV

Grammar and Vocabulary

4.1 Prepositions
4.2 Conjunctions
4.3 Punctuation
4.4 Idioms and Phrases: A bird of ill omen, A bird's eye view, A burning question, A child's play, A cat and dog life, A feather in one's cap, A fish out of water, A shark, A snail's pace, A snake in the grass, A wild goose chase, As busy as a bee, As faithful as dog, Apple of One's eye, Behind one's back, Breath one's last, Below the belt, Beat about the bush, Birds of a feather flock together, Black Sheep, Blue blood, By hook or crook, Chicken hearted, Cut a sorry figure ,Hand in glove, In black and white, In the twinkling, In full swing ,Is blind as a bat, No rose without a thorn, Once in a blue moon, Out of the frying pan in to the fire, know no bounds ,To back out, To bell the cat, To blow one's trumpet, To call a spade a spade, To cut one's coat according to one's cloth, To eat humble pie, To give ear to, To have a thing on one's finger tips, To have one's foot in the grave, To hold one's tongue, To kill two birds with one stone, To make an ass of oneself, To put two and two together, To the back bone, Turn coat, ups and downs.
4.5 Pairs of words commonly misused and confused: Accept-except, Access-excess, Affect-effect, Artificial- artful, Aspire-expire, Bail-bale, Bare-bear, Berth-birth, Beside-besides, Break-brake, Canvas-canvass, Course- coarse, Casual-causal, Council-counsel, Continual-continuous, Coma-comma, Cue- queue, Corpse- corps-core, Dairy-diary,

Desert-dessert, Dual-duel, Dew- due, Die-dye, Draft- draught-drought, Device-devise, Doze-dose, Eligible-illegible, Emigrant- immigrant, Envelop-envelope, Farther-further, Gate-gait, Goal-goal, Human-humane, Honorable-honorary, Hail-hale, Hair-heir-hare, Industrial-industrious, Impossible- impassable, Idle-idol-ideal, Lose-loose, Later-latter, Lesson-lessen, Main-Mane, Mental-mantle, Metal-mettle, Meter-metre, Oar-ore, Pray-prey, Plain-plan, Principal - principle, Personal- personnel, Roll- role, Route-rout- roote, Stationary-stationery, Union- unity, Urban- urbane, Vocation- vacation, Vain- vein-vane, Vary- very.

4.6 Translation of Administrative and Technical Terms in Hindi or Mother tongue: Academy, Abandon, Acting in official capacity, Administrator, Admission, Aforesaid, Affidavit, Agenda, Alma Master, Ambiguous, Appointing Authority, Apprentice, Additional, Advertisement, Assistant, Assumption of charge, Assurance, Attested copy, Bonafide, Bond, Cashier, Chief Minister, Chief Justice Clerical error, Commanding ,Officer, Consent, Contractor, corruption, Craftsman, Compensation, Code, Compensatory allowance, Compile, Confidential letter, Daily Wager, Data, Dearness allowance, Death - Cum Retirement, Dispatch, Dispatch Register, Disciplinary, Disciplinary Action, Disparity Department, Dictionary, Director, Director of Technical Education, Earned Leave, Efficiency Bar, Estate, Exemption, Executive Engineer, Extraordinary, Employment Exchange, Flying Squad, General Body, Head Clerk, Head Office, High Commission, Inconvenience, Income Tax, Indian Assembly Service, Justify, Legislative Assembly, Negligence, Officiating ,Office Record, Office Discipline, On Probation, Part Time, Performance, Polytechnic, Proof Reader Precautionary, Provisional, Qualified, Regret, Responsibility, Self-Sufficient, Senior, Simultaneous ,Staff, Stenography ,Superior, Slate, Takeover, Target Data Technical Approval, Tenure, Temporary, Timely Compliance, Under Investigation, Under Consideration, Verification, Viva-voce, Write off, Working Committee, Warning, Yours Faithfully , Zero Hour.

UNIT V Employability Skills

5.1 Presentation Skills: How to prepare and deliver a good presentation

5.2 Telephone Etiquettes

5.3 Importance of developing employable and soft skills

5.4 Resume Writing: Definition, Kinds of Resume, Difference between Bio-data and Curriculum Vitae and Preparing a Resume for Job/ Internship

5.5 Group discussions: Concept and fundamentals of GD, and learning Group Dynamics.

5.6 Case Studies and Role Plays

PRACTICAL EXERCISES

1. Reading Practice of the above lessons in the Lab Activity classes.
2. Comprehension exercises of unseen passages along with the given lessons.
3. Vocabulary enrichment and grammar exercises based on the above selective readings.
4. Situational Conversation: Requesting and responding to requests; Expressing sympathy and condolence.
5. Warning; Asking and giving information.
6. Getting and giving permission.
7. Asking for and giving opinions.
8. A small formal and informal speech.
9. Seminar.
10. Debate.
11. Interview Skills: Preparing for the Interview and guidelines for success in the Interview and significance of acceptable body-language during the Interview.
12. Written Drills will be undertaken in the class to facilitate a holistic linguistic competency among learners.
13. Participation in a GD, Functional and Non-functional roles in GD, Case Studies and Role Plays
14. Presentations, using audio-visual aids (including power-point).
15. Telephonic interviews, face to face interviews.
16. Presentations as Mode of Communication: Persuasive Presentations using multi-media aids.
17. Practice of idioms and phrases on: Above board , Apple of One's eye , At sea, At random, At large, A burning question, A child's play, A wolf in sheep's clothing, A deal, Breath one's last, Bid fair to, Beat about the bush, Blue Blood, Big Gun, Bring to Book, Cut a sorry figure, Call names, Carry weight, Dark Horse, Eat Humble pie, Feel small, French leave, Grease the palm, Go against the grains, Get One's nerves, Hard and Fast, Hue and Cry, Head and ears, In full swing, Jack of all trades, know no bounds, kiss the dust, Keep an eye on, Lion's share, learn by rote, Null and void, on the cards, Pull a long face, Run amuck, Right and Left, Rain on Shine, Small talk, Take to one's heels, Tooth and nail, to take by storm, , Wet blanket, Yearn for.

RECOMMENDED BOOKS

1. Alvinder Dhillon and Parmod Kumar Singla, "Text Book of English and Communication Skills Vol – 1, 2", M/s Abhishek Publications, Chandigarh.
2. J Sethi, Kamlesh Sadanand & DV Jindal, "Course in English Pronunciation", PHI Learning Pvt. Ltd., New Delhi.
3. Wren and Martin, "High School English Grammar and Composition" .
4. NK Aggarwal and FT Wood, "English Grammar, Composition and Usage", Macmillan Publishers India Ltd., New Delhi.
5. RC Sharma, and Krishna Mohan, "Business Correspondence & Report Writing", (4^{th} Edition), by Tata MC Graw Hills, New Delhi.
6. Varinder Kumar, Bodh Raj & NP Manocha, "Business Communication Skills", Kalyani Publisher, New Delhi.
7. Kavita Tyagi & Padma Misra, "Professional Communication", PHI Learning Pvt. Ltd., New Delhi.
8. Nira Konar, "Communication Skills for Professionals", PHI Learning Pvt. Ltd., New Delhi.
9. Krishna Mohan & Meera Banerji, "Developing Communication Skills", (2^{nd} Edition), Macmillan Publishers India Ltd., New Delhi.
10. M. Ashraf Rizwi, "Effective Technical Communication", Tata MC Graw Hills, New Delhi.
11. Andrea J Rutherford, "Basic Communication Skills for Technology", Pearson Education, New Delhi.

INSTRUCTIONAL STRATEGY

This is practice based subject and topics taught in the class should be practiced in the Lab regularly for development of required communication skills in the students. Emphasis should be given on practicing of communication skills. This subject contains five unit of equal weight age.

4.2 MACHINE LEARNING

L	P
3	4

RATIONALE

Contents of this course provide fundamental base for machine learning and python. Contents of this course will enable students to use basic exercises of machine learning in python include probability, clustering and graphical representation. It is also a pre-requisite for understanding of machine learning on higher level.

COURSE OUTCOMES

After undergoing this course, the learners will be able to:

CO1: Comprehend types of machine learning algorithms and framework for building machine learning models.

CO2: Apply the basic features of Python language to machine learning tasks.

CO3: Prepare plots such as bar plot, histogram, distribution plot, box plot, scatter plot, pair plot, and heat maps to find insights.

CO4: Illustrate simple and multiple linear regression and its applications in predictive analysis.

DETAILED CONTENTS

UNIT I Introduction to Machine Learning

Introduction to Analytics and machine learning, uses of machine learning, major frameworks use for machine learning models, examples of learning systems, evaluating learning systems, process of building learning systems, assumption and reality of learning, Suitability of python, python stack for data science, introduction to Anaconda platform.

UNIT II Introduction to Python

Declaration of variables, conditional statements, generating sequence numbers, control flow statements, functions, collections-list, tuples, sets and dictionaries, strings, functional programming -Maps and Filters, modules and packages, mean, median, mode, range and other features.

UNIT III Descriptive Analysis and Probability

Introduction to dataset in python-description, loading of dataset, displaying of records, summary, slicing, indexing, sorting, grouping, aggregating and joining, handling missing values, exploration and data visualization- drawing plots, bar graph, histogram, Introduction to Probability-basics, methods for probability in python, linear combinations, weighted sums and dot products, a geometric representation.

UNIT IV Clustering and Forecasting

Introduction to clustering, clustering technique, k-means clustering, dendrogram and elbow method, optimal cluster, hierarchal clustering, difference between k- means clustering and hierarchal clustering. Introduction to forecasting, components of time-series data, forecasting using Moving Average Model (MA), calculating forecast accuracy, forecasting using Auto Regressive model (AR), combination of MA and AR- ARMA.

UNIT V Linear Regression

Simple Linear Regression, Steps in Building a Regression Model, Building Simple Linear Regression Model, Creating Feature Set (X) and Outcome Variable (Y), Splitting the Dataset into Training and Validation Sets, Fitting the Model, Residual Analysis and Outlier analysis.

PRACTICAL EXERCISES

1. How to install anaconda platform and Jupiter notebook.
2. Program to create list, tuple and dictionary.
3. Program to calculate range, mean, median and mode using maths module.
4. Program to perform function of slicing, indexing and joining of data frame.
5. Program to create bargraph and histogram.
6. Fashion trends online (FTO) is an e-commerce company that sells women apparel. It is observed that 10% of their customers return the items purchased by them for many reasons (such as size, color, and material mismatch). On a specific day, 20 customers purchased items from FTO. calculate:
    a. Probability that exactly 5 customers will return the items.
    b. Probability that a maximum of 5 customers will return the items.
    c. Probability that more than 5 customers will return the items purchased by them.
    d. Average number of customers who are likely to return the items and the variance and the standard deviation of the number of returns.

7. Program to create scatter plot for clustering on relationship between age and income of customers

	income	age
0	41100.0	48.75
1	54100.0	28.10
2	47800.0	46.75
3	19100.0	40.25
4	18200.0	35.80

8. Program to forecast a sale of a company for an item by taking data of 10 months and forecast production for 37^{th} month.

SUGGESTED WEBSITES

1. http://nptel.ac.in
2. https://ekumbh.aicte-india.org

RECOMMENDED BOOKS

1. Manranjan Pradhan Dinesh Kumar, "Machine Learning Using Python", Wiley.
2. Mark E. Fenner, "Machine Learning with Python for Everyone", Pearson.
3. Ethem Alpaydın, "Introduction to Machine Learning", the MIT Press, Cambridge, Massachusetts, London, England.
4. Tom M. Mitchell, "Machine Learning", McGraw-Hill Science, ISBN: 0070428077.
5. Shai Shalev- Schwartz and Shai Ben-David, "Understanding Machine Learning: From Theory to Algorithms, c 2014", Cambridge University Press.

INSTRUCTIONAL STRATEGY

Teacher should lay-emphasis on development of understanding amongst students about basic principles. This may be achieved by conducting quiz tests and by giving home assignments. The teachers should also conduct laboratories classes themselves encouraging each should to perform with his/her own hands and draw conclusions. This is practice based subject and topics taught in the class should be practiced in the Lab regularly for development of required communication skills in the students. This subject contains five units of equal weight age.

4.3 ALGORITHM DESIGN TECHNIQUES

L	P
2	4

RATIONALE

The algorithm makes us to break anything into small steps, for easy and effective understanding of the complex things. An algorithm generally is a sequence of instructions, which eventually confirms the successful completion of a specific task. Coding involves only 20 to 30 % time in a project, most of the time goes into designing things with the best and optimum algorithms to save on the company's resources (servers, computation power, etc.). This course helps the students to learn the basics about the algorithm and to implement them using Python language.

COURSE OUTCOMES

After undergoing this course, the learners will be able to:

CO1: Discuss the fundamentals of algorithm.
CO2: Describe the analysis of algorithm efficiency using different notations.
CO3: Illustrate various problems using Brute force and Divide and-Conquer Technique..
CO4: Apply Analysis Framework

DETAILED CONTENTS

UNIT I

Introduction

Algorithm, Fundamentals of Algorithmic problem solving, Important problem types. Fundamental data structures.

UNIT II

Fundamentals of the Analysis of Algorithm Efficiency

Analysis Framework, Measuring the input size, Units for measuring Running time, Orders of Growth, Worst-case, Best-case and Average-case efficiencies, Asymptotic Notations and Basic Efficiency classes, Informal Introduction, O-notation, Ω-notation, θ-notation, mathematical analysis of non-recursive algorithms, mathematical analysis of recursive algorithms.

UNIT III

Brute Force & Exhaustive Search

Introduction to Brute Force approach, Selection Sort and Bubble Sort, Sequential search, Exhaustive Search- Travelling salesman Problem and Knapsack Problem, Depth First Search, Breadth First Search.

UNIT IV

Divide-and-Conquer

Introduction, Merge Sort, Quick Sort, Binary Search, Binary Tree traversals and related properties.

UNIT V

Greedy Technique

Introduction, Prim's Algorithm, Kruskal's Algorithm, Dijkastra's Algorithm

PRACTICAL EXERCISES

Implement the following using Python

1. Write a program for sequential search.
2. Write a program for finding the value of the largest element in a list of n numbers.
3. Write a program for computing the factorial function for an arbitrary non-negative integer.
4. Write a program for sequential search and Analyze its worst-case, best-case and average-case efficiencies.
5. Write a program for closest pair problem using brute force.
6. Write a program for Selection sort.
7. Write a program for Bubble sort.
8. Write a program for Travelling salesman problem.
9. Write a program for binary search
10. Write a program for Merge sort.
11. Write a program for Quick Sort.
12. Write a program for binary search for best case, worst case and average cases.
13. Write a program for binary tree traversals.

RECOMMENDED BOOKS

1. Anany Levitin, “Introduction to the Design and Analysis of Algorithms”, Pearson Publication.
2. Das Gupta, “Algorithms”, TMH.
3. Ellis Horowitz, and Sartaj Sahni, “Fundamentals of Computer Algorithms”, Galgotia Publications.

SUGGESTED WEBSITES

1. http://nptel.ac.in
2. https://ekumbh.aicte-india.org
3. http://www.tutorialspoint.com/data_structures_algorithms

INSTRUCTIONAL STRATEGY

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4.4 INTERNET OF THINGS

L	P
2	4

RATIONALE

The scope and the demand for the Internet of Things are high, and also the salary levels keep increasing because of the increasing demand. As the businesses are exploring more to the adoption of IoT, there are times when they lack the skills and knowledge about the same, and that is the time when the need of professionals in this field is required. The objective of this Diploma course is to provide the candidates the Detail knowledge and skills in the Internet of Things (IoT) discipline. The explosive growth of the "Internet of Things" is changing our world and the rapid drop in price for typical IoT components is allowing people to innovate new designs and products at home.

COURSE OUTCOMES

After undergoing this course, the learners will be able to:

CO1: Comprehend the concept of Internet of Things and its applications

CO2: Acquire and analyse sensor generated data

CO3: Interface basic sensors with microcontrollers.

CO4: Explore the potential applications of IoT in various industries

DETAILED CONTENTS

UNIT I

Introduction to IoT

Introduction to Internet of Things (IoT), Definition, Characteristics, Physical design of IoT, Logical design, Functional blocks, Communication models & APIs, Advantage & Disadvantage of IoT.

UNIT II

Implementation of IoT using Arduino

Arduino Uno Architecture, Basics of Embedded C programming for Arduino, Interfacing of Temperature, Humidity, Motion, Light and Gas Sensor with Arduino, Interfacing of Actuators with Arduino, Interfacing of Relay Switch and Servo Motor with Arduino.

UNIT III

Challenges in IoT

Design challenges, Development challenges, Security challenges, Other challenges

UNIT IV

Domain specific applications of IoT

Home automation, Industrial applications, Surveillance applications, Other IoT applications

UNIT V

Developing IoTs

Introduction to different IoT tools, Developing sensor-based application through embedded system platform.

PRACTICAL EXERCISES

(using Arduino/8051/ Microcontrollers-interfacing sensors)

i. Interfacing Light Emitting Diode(LED)- Blinking LED
ii. Interfacing Button and LED – LED blinking when button is pressed
iii. Interfacing Light Dependent Resistor (LDR) and LED as automatic night lamp
iv. Interfacing Temperature Sensor(LM35) and/or humidity sensor (DHT11)
v. Interfacing Liquid Crystal Display(LCD) – display data generated by sensor on LCD
vi. Interfacing Air Quality Sensor-pollution (MQ135) - display data on LCD, switch on LED when data sensed is higher than specified value.
vii. Interfacing Bluetooth module (HC05)- receiving data from mobile phone on Arduino and display on LCD
viii. Interfacing Relay module to demonstrate Bluetooth based home automation application. (using Bluetooth and relay).
ix. To interface Bluetooth with Arduino/Raspberry Pi and write a program to turn LED ON/OFF when '1'/'0' is received from smartphone using Bluetooth

RECOMMENDED BOOKS

1. Vijay Madisetti, Arshdeep Bahga, "Internet of Things: A Hands on Approach", University Press.
2. Yashavant Kanetkar, Shrirang Korde, "21 Internet of Things (IOT) Experiments".
3. Neerparaj Rai, "Arduino Projects For Engineers".

4. Chandra S.S.V, “Artificial Intelligence and Machine Learning”.
5. Adrian McEwen & Hakim Cassimality, “Designing the Internet of Things”, Wiley India.
6. Olivier Hersent, David Boswarthick, Omar Elloumi, “The Internet of Things – Key Applications and Protocols”, Wiley Publication, ISBN: 9788126557653.
7. Michael Miller, “The Internet of Things”, Pearson, By ISBN: 9789332552456.

SUGGESTED WEBSITES

1. http://nptel.ac.in
2. https://ekumbh.aicte-india.org
3. https://www.bbvaopenmind.com/en/iot-implementation-and-challenges
4. http://www.cisco.com/c/dam/en_us/solutions/

INSTRUCTIONAL STRATEGY

Teacher should lay-emphasis on development of understanding amongst students about basic principles. This may be achieved by conducting quiz tests and by giving home assignments. The teachers should also conduct laboratories classes themselves encouraging each should to perform with his/her own hands and draw conclusions. This is practice based subject and topics taught in the class should be practiced in the Lab regularly for development of required communication skills in the students. This subject contains five units of equal weight age.

4.5 PROGRAMME ELECTIVE - I
4.5.1 CLOUD COMPUTING

L	P
2	2

RATIONALE

This course offers a good understanding of cloud computing concepts and challenges faced in implementation of cloud computing. It also offers the concept of Virtualization along with security issues faced in the field of cloud computing.

COURSE OUTCOMES

After undergoing this course, the learners will be able to:

CO1: Explain core concepts of cloud computing paradigm.
CO2: Describe various Service and Deployment Models
CO3: Detail SLA management in Cloud Computing
CO4: Illustrate the fundamental concepts of cloud storage apply the concept of virtualization.

DETAILED CONTENTS

UNIT I

Introduction

Evolution of Cloud Computing, Cloud Computing Overview, Characteristics, Applications, Benefits, Challenges. Major Cloud Vendors/Service Provider in the world.

UNIT II

Service and Deployment Models

Cloud Computing Service Models: Infrastructure as a Service, Platform as a Service, Software as a Service, Cloud Computing Deployment Models: Private Cloud; Public Cloud, Community Cloud, Hybrid Cloud, Major Cloud Service providers.

UNIT III

Service Level Agreement (SLA) Management

Overview of SLA, Types of SLA, SLA Life Cycle, SLA Management Process.

UNIT IV Virtualization Concepts

Overview of Virtualization, Types of Virtualization, Benefits of Virtualization, Hypervisors and its types.

UNIT V Cloud Storage &Security

Storage as a Service, Benefits and Challenges, Storage Area Networks (SANs), Infrastructure Security, Network Level Security, Data Security & Privacy Issues, Legal Issues in Cloud Computing.

PRACTICAL EXERCISES

1. Introduction to Cloud Vendors: Amazon, Microsoft, IBM.
2. Setting up Virtualization using Virtualbox/VMWare Hypervisor
3. Introduction to OwnCloud and its features.
4. Installation and configuration of OwnCloud software for SaaS
5. Installing Open Source Cloud simulation software Cloud Sim.

RECOMMENDED BOOKS

1. Rajkumar Buyya, James Broberg, Andrzej Goscinski, " Cloud Computing: Principles and Paradigms, Wiley.
2. Barrie Sosinsky, " Cloud Computing Bible", Wiley, 2011.
3. Judith Hurwitz, Robin Bloor, Marcia Kaufman,Fern Halper, " Cloud Computing for Dummies", Wiley, 2010.

SUGGESTED WEBSITES

1. http://nptel.ac.in
2. https://ekumbh.aicte-india.org
3. http://swayam.gov.in

INSTRUCTIONAL STRATEGY

Teacher should lay-emphasis on development of understanding amongst students about basic principles. This may be achieved by conducting quiz tests and by giving home assignments. The teachers should also conduct laboratories classes themselves encouraging each should to perform with his/her own hands and draw conclusions. This is practice based subject and topics taught in the class should be practiced in the Lab regularly for development of required communication skills in the students. This subject contains five units of equal weight age.

4.5.2 LINUX AND ITS APPLICATIONS

L	P
2	2

RATIONALE

The knowledge of this subject will enable the students to understand the concepts of Linux and its potential. Most of the infrastructure that powers the internet, including routers and servers, is based on Linux. Most of the open system software's will work on Linux. The course will helps the student to learn the basics of Linux and how to go ahead with Linux. The students will also get hand on experience of Linux after undergoing this course.

COURSE OUTCOMES

After undergoing this course, the learners will be able to:

CO1: Learning of fundamental of Linux operating System.
CO2: Exploring Linux file system with basic and advanced commands.
CO3: Working with Shell scripting and regular expressions.
CO4: Analyzing the programming behavior based on programming development and management on Linux Systems.
CO5: Developing creativity as system administrative with networking expertization in Linux Systems.

DETAILED CONTENTS

UNIT I

LINUX Fundamentals

Linux, Why we need LINUX?, History of LINUX, Benefits of LINUX, LINUX Distributions, Linux Architecture, Installation of LINUX Operating System using USB Drive, DVD, Virtual Machine, LINUX Vs. Windows, UNIX Vs. LINUX, Linux using Command Line Interface (Terminal) and Graphical User Interface, Logging in and Logging out, Linux files, i-nodes, The Vi Editor, Input Mode—Entering and Replacing Text, Saving Text and Quitting.

UNIT II

Linux File System and Regular Expressions

Linux File Ownership, Linux File Permissions, Changing file/directory permissions in Linux Using 'chmod' command, Absolute(Numeric) Mode in Linux, Symbolic Mode in Linux, Changing Ownership and Group in Linux, Commands pwd, cd, Navigating through multiple directories, Relative and Absolute Paths, Creating & Viewing Files using cat, mkdir, rmdir, ls, wc, password, who, whoami, Introducing regular expression patterns: grep, egrep, shell scripting, C Compiler, C Compiler Options, C shell Script & Programming

UNIT III

System Administration

Processes, starting and stopping processes, initialization of processes, rc and init files, job control – at, batch, cron, time, network files, security, authentication, password administration, signals handlers, threading

UNIT IV

Networking Processes in Linux

Linux I/O system, Networking tools : Ping, Telnet, FTP, Router, Firewalls, Backup and Restore tar, cpio, dd utility, mail command, Linux Network Security. Case Study: LINUX Operating System as open source free software.

PRACTICAL EXERCISES

1. Installation of Linux Operating System
2. Usage of directory management commands of Linux: ls, cd, pwd, mkdir, rmdir
3. Usage of File Management commands of Linux: cat, chmod,cp, mv, rm, pg, more, find
4. Use the general purpose commands of Linux: wc, od, lp, cal , date, who, whoami
5. Using the simple filters: pr, head, tail, cut, paste, nl, sort
6. Communication Commands: news, write, talk, mseg, mail, wall
7. Write a shell/C program that finds the factorial of a number.
8. Write a shell/C program that finds whether a given number is prime or not.
9. Write a shell/C program to find the average of three numbers.
10. Write a shell/C program that will convert all the text of the file from lowercase to uppercase.
11. Practice of Working with VI Editor.
12. Working on regular expressions using grep and egrep
13. Practice on job Control in LINUX using at, batch, cron

14. Hands on practice on networking tools like ping, telnet, FTP, etc.
15. Practice on Backup and Restore commands like tar, cpio, dd utility, mail command

SUGGESTED WEBSITES

1. http://nptel.ac.in
2. https://ekumbh.aicte-india.org
3. http://swayam.gov.in

RECOMMENDED BOOKS

1. Sumitbha Das, "Unix – Concept and Applications", TMH.
2. B.M Harwani, "Unix and Shell Programming", Oxford University Press.
3. Neil Matthew, Richard Stones, " Beginning Linux Programming" , Wrox-Shroff.
4. Welsh & Kaufmann, "Running Linux", O'Reiley & Associates.

INSTRUCTIONAL STRATEGY

Teacher should lay-emphasis on development of understanding amongst students about basic principles. This may be achieved by conducting quiz tests and by giving home assignments. The teachers should also conduct laboratories classes themselves encouraging each should to perform with his/her own hands and draw conclusions. This is practice based subject and topics taught in the class should be practiced in the Lab regularly for development of required communication skills in the students. This subject contains four units of equal weight age.

4.5.3 EMBEDED SYSTEM & DESIGN

L	P
2	2

RATIONALE

Embedded systems and Micro-controllers have also assumed a great significance in the electronic and consumer goods industry and are a very vital field. The subject aims expose students to the embedded systems besides giving them adequate knowledge of Micro controllers.

COURSE OUTCOMES

After undergoing this course, the learners will be able to:

CO1: Explain embedded operating systems
CO2: Program PIC microcontroller and AVR microcontroller
CO3: Interface sensors with microcontroller
CO4: Troubleshoot and repair microcontroller based appliances.

DETAILED CONTENTS

UNIT I

Introduction

Embedded system, history of embedded systems, embedded system architecture, Functional structure of embedded system

UNIT II

Embedded operating systems

Real-time operating system, factors affecting embedded systems, applications of embedded systems, embedded systems characteristics and features, Reliability of embedded systems, embedded systems versus general purpose systems and selection criteria of microcontroller.

UNIT III

PIC microcontroller

Introduction, PIC block diagram, function of each block, PIC Architecture & Programming, PIC I/O Port Programming

UNIT IV

AVR microcontroller

Introduction, Block diagram, function of each block.

UNIT V

Comparison between 8051, PIC and AVR,

Steps involved in development of a project,

interfacing of LED, 7-segment display, buzzer, relay and sensors.

PRACTICAL EXERCISES

1. Demonstration and study of PIC microcontroller kit
2. Simple Programmes on PIC kit
3. Design PIC based Security System
4. Design AVR based Temperature indicator cum controller.
5. Interfacing of LED,
6. Interfacing of 7-segment display,
7. Interfacing of buzzer and a programme on its application
8. Interfacing of relay and sensors and a programme on its application

RECOMMENDED BOOKS

1. Muhammad Ali Mazidi, Rolin Mckinlay, Janice Gilispie Mazidi, "Microcotroller and Embedded Systems using Assembly and C", Pearson.
2. Kamal, "Embedded Systems - Architecture, Programming, Design", R. Tata McGraw Hill, New Delhi.
3. Muhammad Ali Mazidi, Rolin Mckinlay, Danny Causey, "PIC Microcontroller and Embedded Systems: Using assembly and C", Pearson.
4. Dhananjay Gadre, "The AVR microcontroller (with CD-ROM)", Tata McGraw Hill Education Private Limited.
5. Books/e-tools/relevant software to be used as recommended by AICTE/HSBTE/NITTTR.

SUGGESTED WEBSITES

1. http://nptel.ac.in
2. https://ekumbh.aicte-india.org
3. http://swayam.gov.in

INSTRUCTIONAL STRATEGY

Teacher should lay-emphasis on development of understanding amongst students about basic principles. This may be achieved by conducting quiz tests and by giving home assignments. The teachers should also conduct laboratories classes themselves encouraging each should to perform with his/her own hands and draw conclusions. This is practice based subject and topics taught in the class should be practiced in the Lab regularly for development of required communication skills in the students. This subject contains five units of equal weight age.

4.6 MINOR PROJECT

L	P
-	6

RATIONALE

Minor project work will help in developing the relevant skills among the students as per National Skill Qualification Framework. It aims at exposing the students to the present and future needs of various relevant industries. It is expected from the students to get familiar with industrial environment. For this purpose, students are required to be involved in Minor Project Work in different establishments.

COURSE OUTCOMES

After undergoing this course, the students will be able to:

CO1: Define the problem statement of the minor project according to the need of industry.
CO2: Work as a team member for successful completion of minor project.
CO3: Write the minor project report effectively.
CO4: Present the minor project report using PPT.

GUIDELINES

Depending upon the interest of the students, they can develop minor projects as per present and future demand of the industry. The supervisors may guide the students to identify their minor project work and chalk out their plan of action well in advance. As a minor project activity each student is supposed to study the operations at site and prepare a detailed project report of the observations/processes/activities. The supervisor may create a group of 4-5 students as per their interest to work as a team for successful completion of the minor project.

The supervisor shall evaluate the students along with one external expert by considering the following parameters:

	Parameter	Weightage
i	Defining problem statement, focus and approach	20%
ii	Innovation / creativity	20%
iii	Report Writing	20%
iv	Power Point Presentation	20%
v	Viva - voce	20%

THIRD YEAR

NSQF LEVEL - 5

18. DIPLOMA PROGRAMME STUDY AND EVALUATION SCHEME

FIFTH SEMESTER

Sr. No.	SUBJECTS	STUDY SCHEME Periods/Week		Credits C L + P = C	MARKS IN EVALUATION SCHEME						Total Marks of Internal & External
					INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT			
		L	P		Th	Pr	Total	Th	Pr	Total	
5.1	Industrial Training - II	-	2	**0+1=1**	-	40	40	-	60	60	100
5.2	***Entrepreneurship Development & Management	3	-	**3+0=3**	40	-	40	60	-	60	100
5.3	**Computer Networks	3	4	**3+2=5**	40	40	80	60	60	120	200
5.4	Relational Database Management System	3	4	**3+2=5**	40	40	80	60	60	120	200
5.5	Deep Learning and its applications	3	2	**3+1=4**	40	40	80	60	60	120	200
5.6	Software Tools for AI & ML	-	8	**0+4=4**	-	40	40	-	60	60	100
	# Student Centered Activities(SCA)	-	3	–	-	-	-	-	-	-	-
Total		**12**	**23**	**22**	**160**	**200**	**360**	**240**	**300**	**540**	**900**

* Common with other Diploma Courses.

** Common with Diploma in Computer Engineering.

Student Centered Activities will comprise of co-curricular activities like extension lectures on Constitution of India, Games, Yoga,Human Ethics, Knowledge of Indian System, Hobby clubs e.g. Photography etc., Seminars, Declamation contests, Educational field visits, N.C.C., NSS, Cultural Activities and self study etc.

SIXTH SEMESTER

Sr. No.	SUBJECTS	STUDY SCHEME Periods/Week		Credits (C) L + P = C	MARKS IN EVALUATION SCHEME						Total Marks of Internal & External
					INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT			
		L	P		Th	Pr	Total	Th	Pr	Total	
6.1	Big Data Analytics	3	4	**3+2=5**	40	40	80	60	60	120	200
6.2	AI Expert systems	4	2	**4+1=5**	40	40	80	60	60	120	200
6.3	Programme Elective-II	3	-	**3+0=3**	40	-	40	60	-	60	100
6.4	Multi-disciplinary Elective (MOOCs+/Offline)	2	-	**2+0=2**	40	-	40	60	-	60	100
6.5	Major Project/ Industrial Training	-	16	**0+8=8**	-	40	40	-	60	60	100
	# Student Centered Activities(SCA)	-	1	-	-	-	-	-	-	-	-
	Total	**12**	**23**	**23**	**160**	**120**	**280**	**240**	**180**	**420**	**700**

\+ Assessment of Open Elective through MOOCs shall be based on assignments out of 100 marks.

Programme Elective-II 6.3.1 Fuzzy Logic and Applications 6.3.2 Network and Information security 6.3.3 Data Warehousing and Mining

Student Centered Activities will comprise of co-curricular activities like extension lectures on Constitution of India, Games, Yoga, Human Ethics, Knowledge of Indian System, Hobby clubs e.g. Photography etc., Seminars, Declamation contests, Educational field visits, N.C.C., NSS, Cultural Activities and self study etc.

19. HORIZONTAL AND VERTICAL SUBJECTS ORGANISATION

Sr. No.	Subjects/Areas	Hours Per Week	
		Fifth Semester	Sixth Semester
1.	Industrial Training - II	2	
2.	Entrepreneurship Development & Management	3	
3.	Computer Networks	7	
4.	Relational Database Management	7	
5.	Deep Learning and its applications	5	
6.	Software Tools for Artificial Intelligence and Machine Learning	8	
7.	Big Data Analytics	-	7
8.	AI Expert systems	-	6
9.	Programme Elective-II	-	3
10	Multi-disciplinary Elective	-	2
11	Major Project/ Industrial Training	-	16
12	Student Centered Activities	3	1
	Total	**35**	**35**

20. COMPETENCY PROFILE AND EMPLOYMENT OPPORTUNITIES

Government and private sectors related to **Artificial Intelligence & Machine Learning** require **supervisors** having well developed skills with clear choice of procedures. They are expected to have complete knowledge and practical skills related to automation and robotics field. They shall be able to communicate clearly with others. Diploma holders after passing NSQF level 5 shall have understanding of desired mathematical skills and understanding of social and natural environment. They are expected to collect, organize and communicate information effectively.

With the rapid technological developments in the field, artificial intelligence is one of the most sought after skills by large technology companies. With many forecasters deeming that computers will take over many manufacturing jobs, programming artificial intelligence is a job for the future. Below are some examples of jobs common for skilled professionals with knowledge in artificial intelligence, robotics, machine learning, and related fields, including a brief job description of each role.

Work requiring knowledge, skills and aptitudes at level 5 will also be carried out in familiar situations, but also ones where problems may arise. Job holders will be able to make choices about the best procedures to adopt to address problems where the choices are clear. Individuals in jobs which require level 5 qualifications will normally be responsible for the completion of their own work and expected to learn and improve their performance on the job. They will require well developed practical and cognitive skills to complete their work. They may also have some responsibility for others' work and learning.

They should be able to Create and evaluate a computer-based AI/ML model, components and process to meet the specific needs of applications and develop and integrate effectively AI/ML based components into user environment. They are expected have good theoretical and practical knowledge of various web technologies and networking of computers to work efficiently in computer related companies. They are also expected to have good knowledge of cloud computing and big data to meet the Industry 4.0 requirements along with good exposure of python programming. With a diploma in AI, there are several employment opportunities available, including: Machine Learning Engineer, Data Scientist, AI Developer, AI Product Manager.

21. PROGRAMME OUTCOMES

The program outcomes are derived from five domains of NSQF Level – 5 namely Process, Professional Knowledge, Professional Skill, Core Skill, Responsibility. After completing this level, the student will be able to:

PO1: Perform task that require well developed skills with clear choice of procedures.

PO2: Acquire knowledge of facts, principles and processes related to Artificial Intelligence & Machine Learning.

PO3: Demonstrate cognitive and practical skills of Artificial Intelligence & Machine Learning. to solve problems

PO4: Develop skills to collect, organize and communicate information.

PO5: Accomplish own work and supervise others work.

PO6: Select online multidisciplinary electives of own interest to promote self-learning.

22. ASSESSMENT OF PROGRAMME AND COURSE OUTCOMES

Programme Outcomes to be assessed	Assessment criteria for the Course Outcomes
PO1: Perform task that require well developed skills with clear choice of procedures.	• Describe wireless networks and cloud computing. • Compile the design of database architecture Apply structured Query language • Apply advanced CNN architectures, for image classification, and object detection,. • Synthesize knowledge from recent research advancements in CNNs • Gain familiarity with basic Python input/output functions. • Programme various email filtering techniques using Python. • Detail the tools required to manage and analyze bi data like Hadoop, NoSql apReduce. • Illustrate principles in achieving big data analytics with scalability and streaming capability. • Integrate multiple knowledge domains • Enhance the Knowledge about the Expert Systems • Apply the latest developments and tools in Knowledge systems. • Elaborate the basics of fuzzy logic • Demonstrate a thorough understanding of various network threats and vulnerabilities. • Analyze network security incidents, identify their root causes, and formulate appropriate response strategies. • Acquire the basic knowledge of data warehousing and mining. • Elaborate the advanced concepts of data mining and learn how to use these concepts.
PO2: Acquire knowledge of facts, principles and processes related to Artificial Intelligence & Machine Learning.	• Demonstrate a comprehensive understanding of convolutional neural networks (CNNs) • Apply advanced CNN architectures, for image classification, and object detection,

	• Evaluate the performance of CNN models. • Gain familiarity with basic Python input/output functions. • Comprehend the knowledge about the decision-making algorithms. • Develop simple game-playing algorithms, game A using Python • Detail the tools required to manage and analyze bi data like Hadoop, NoSql apReduce. • Comprehend the concepts of Artificial Intelligence and Expert Systems. • Display analytical and research abilities. • Enhance the Knowledge about the Expert Systems • Apply the latest developments and tools in Knowledge systems. • Illustrate different operations based on fuzzy sets • Acquire knowledge regarding different qualifiers and relations. • Implement different applications based on fuzzy logic. • Acquire the skills necessary to design, implement, and maintain effective network defense mechanisms. • Acquire the basic knowledge of data warehousing and mining. • Learn about usage of warehouses according to business perspective. • Elaborate the advanced concepts of data mining and learn how to use these concepts.
PO3: Demonstrate cognitive and practical skills of Artificial Intelligence & Machine Learning. to solve problems	• Troubleshoot networking related issues. • Familiarize with the database concepts • Compile the design of database architecture Apply structured Query language • Illustrate the nuances of RDBMS • Apply advanced CNN architectures, for image

	classification, and object detection,. • Utilize deep learning frameworks to deploy CNN models • Synthesize knowledge from recent research advancements in CNNs • Programme various email filtering techniques using Python. • Develop simple game-playing algorithms, game A using Python • Detail the tools required to manage and analyze bi data like Hadoop, NoSql apReduce. • Illustrate principles in achieving big data analytics with scalability and streaming capability. • Display analytical and research abilities. • Apply the latest developments and tools in Knowledge systems. • Implement different applications based on fuzzy logic. • Demonstrate a thorough understanding of various network threats and vulnerabilities. • Acquire the skills necessary to design, implement, and maintain effective network defense mechanisms. • Analyze network security incidents, identify their root causes, and formulate appropriate response strategies. • Illustrate the basic use of OLAP, MOLAP and ROLAP servers. • Elaborate the advanced concepts of data mining and learn how to use these concepts.
PO4: Develop skills to collect, organize and communicate information.	• Comprehend about present and future requirement of industries. • Develop writing, speaking and presentations skills • Identify the various resources / sources and / or schemes for starting a new venture. • Conduct market survey and prepare project report.

	• Learn about the basic concepts of networking models. • Familiarize with the database concepts • Synthesize knowledge from recent research advancements in CNNs • Imbibe the knowledge about fraud detection techniques • Display analytical and research abilities. • Integrate multiple knowledge domains • Demonstrate a thorough understanding of various network threats and vulnerabilities. • Acquire the basic knowledge of data warehousing and mining. • Define the problem statement of the Industrial training / Major project according to the need of industry. • Write the Major project report effectively. • Present the Major project report using PPT.
PO5: Accomplish own work and supervise others work.	• Familiarize with the working environment of industries • Apply necessary safety precautions and measures. • Comprehend about present and future requirement of industries. • Work in team for solving industrial problems • Develop competencies and skills required by relevant industries. CO6: Develop writing, speaking and presentations skills. • Comprehend the importance of entrepreneurship and its role in nation's development. • Classify the various types of business and business organizations. • Identify the various resources / sources and / or schemes for starting a new venture. • Conduct market survey and prepare project report. • Connect various networking devices. • Troubleshoot networking related issues.

	• Synthesize knowledge from recent research advancements in CNNs • Imbibe the knowledge about fraud detection techniques • Develop simple game-playing algorithms, game AI. using Python • Demonstrate a thorough understanding of various network threats and vulnerabilities. • Acquire the skills necessary to design, implement, and maintain effective network defense mechanisms. • Develop an awareness of the ethical and legal implications associated with network security practices. • Analyze network security incidents, identify their root causes, and formulate appropriate response strategies. • Learn about usage of warehouses according to business perspective. • Elaborate the advanced concepts of data mining and learn how to use these concepts. • Define the problem statement of the Industrial training / Major project according to the need of industry. • Work as a team member for successful completion of Industrial training / Major project. • Write the Major project report effectively. • Present the Major project report using PPT.
PO6: Select online multidisciplinary electives of own interest to promote self-learning.	• Apply critical thinking in problem solving. • Demonstrate self and time management. • Display analytical and research abilities. • Integrate multiple knowledge domains. • Enhance the scope and depth of learning.

23. SUBJECTS & CONTENTS

(THIRD YEAR)

FIFTH SEMESTER

5.1 INDUSTRIAL TRAINING - II

L	P
-	2

RATIONALE

Industrial training will help the students to understand the working environment of relevant industries. The student will learn to work in team to solve the industrial problems. It will also give exposure about the present and future requirements of the relevant industries. This training is very important for development of required competencies and skills for employment and start– ups.

COURSE OUTCOMES

After undergoing the training, the students will be able to:

CO1: Familiarize with the working environment of industries

CO2: Apply necessary safety precautions and measures.

CO3: Comprehend about present and future requirement of industries.

CO4: Work in team for solving industrial problems

CO5: Develop competencies and skills required by relevant industries.

CO6: Develop writing, speaking and presentations skills.

PRACTICAL EXERCISES

1. Report writing based on industrial training.
2. Preparation of Power Point Slides based on industrial training and presentation by the candidate.
3. Internal Evaluation based on quality of Report, PPT preparation, PPT presentation and answer to queries.
4. External Evaluation based on quality of Report, PPT preparation, PPT presentation and answer to queries.

GUIDELINES

Students will be evaluated based on Industrial training report and their presentation using Power Point about the knowledge and skills gained during the training. The Head of the Department will depute faculty coordinators by assigning a group of students to each. The coordinators will mentor and guide the students in preparing the PPTs for final presentation. The following performance parameters are to be considered for assessment of the students out of 100 marks:

	Parameter	**Weightage**
i	Industrial assessment of the candidate by the trainer	40%
ii	Report Writing	20%
iii	Power Point Presentation	20%
iv	Viva-voce	20%

5.2 ENTREPRENEURSHIP DEVELOPMENT AND MANAGEMENT

L	P
3	-

RATIONALE

In the present day scenario, it has become imperative to impart entrepreneurship and management concepts to students so that a significant percentage of them can be directedtowards setting up and managing their own small enterprises. This subject focuses on imparting the necessary competencies and skills of enterprise set up and its management.

COURSE OUTCOMES

Upon completion of this subject, students will be able to:

CO1: Comprehend the importance of entrepreneurship and its role in nation's development.
CO2: Classify the various types of business and business organizations.
CO3: Identify the various resources / sources and / or schemes for starting a new venture.
CO4: Explain the principles of management including its functions in an organisation.
CO5: Conduct market survey and prepare project report.

DETAILED CONTENTS

UNIT I

Entrepreneurship: Concept and definitions, classification and types of entrepreneurs, entrepreneurial competencies, Traits / Qualities of entrepreneurs, manager v/s entrepreneur, role of Entrepreneur, barriers in entrepreneurship, Sole proprietorship and partnership forms of business organisations, small business vs startup, critical components for establishing a start-up, Leadership: Definition and Need, Manager Vs leader, Types of leadership

UNIT II

Definition of MSME (micro, small and medium enterprises), significant provisions of MSME Act, importance of feasibility studies, technical, marketing and finance related problems faced bynew enterprises, major labor issues in MSMEs and its related laws, Obtaining financial assistance through various government schemes like Prime Minister Employment Generation Program (PMEGP) Pradhan Mantri Mudra Yogna (PMMY) , Make in India, Start up India, Stand up India

National Urban Livelihood Mission (NULM); Schemes of assistance by entrepreneurial support agencies at National, State, District level: NSIC, NRDC, DC:MSME, SIDBI, NABARD, Commercial Banks, SFC's TCO, KVIB, DIC, Technology Business Incubator (TBI) and Science and Technology Entrepreneur Parks (STEP).

UNIT III

NATURE AND FUNCTIONS OF MANAGEMENT: Definition, Nature of Management, Management as a Process, Management as Science and Art, Management Functions,Management and Administration, Managerial Skills, Levels of Management; Leadership.

PLANNING AND DECISION MAKING: Planning and Forecasting - Meaning and definition, Features, Steps in Planning Process, Approaches, Principles, Importance, Advantages and Disadvantages of Planning, Types of Plans, Types of Planning, Management by Objective. Decision Making-Meaning, Characteristics.

UNIT IV

ORGANISING AND ORGANISATION STRUCTURE: Organising Process - Meaning and Definition, Characteristics Process, Need and Importance, Principles, Span of Management, Organisational Chart - Types, Contents, Uses, Limitations, Factors Affecting Organisational Chart.

STAFFING: Meaning, Nature, Importance, Staffing process. Manpower Planning, Recruitment, Selection, Orientation and Placement, Training, Remuneration.

CONTROLLING AND CO-ORDINATION Controlling - Meaning, Features, Importance, Control Process, Characteristics of an effective control system, Types of Control. Co-ordination - characteristics, essentials.

UNIT V

Market Survey and Opportunity Identification, Scanning of business environment, Assessment of demand and supply in potential areas of growth, Project report Preparation, Detailed project report including technical, economic and market feasibility, Common errors in project report preparations, Exercises on preparation of project report.

RECOMMENDED BOOKS

1. BS Rathore and Dr JS Saini, "A Handbook of Entrepreneurship", Aapga Publications, Panchkula, Haryana.

2. Entrepreneurship Development, Tata McGraw Hill Publishing Company Ltd., New Delhi.
3. CB Gupta and P Srinivasan, "Entrepreneurship Development in India", Sultan Chand and Sons, New Delhi.
4. Poornima M Charantimath, "Entrepreneurship Development - Small Business Enterprises", Pearson Education, New Delhi.
5. David H Holt, "Entrepreneurship: New Venture Creation", Prentice Hall of India Pvt. Ltd., New Delhi.
6. PM Bhandari, "Handbook of Small Scale Industry".
7. L M Prasad, "Principles and Practice of Management", Sultan Chand & Sons, New Delhi.

SUGGESTED WEBSITES

1. https://ipindia.gov.in/

INSTRUCTIONAL STRATEGY

Some of the topics may be taught using question/answer, assignment or seminar method. The teacher will discuss stories and case studies with students, which in turn will develop appropriate managerial and entrepreneurial qualities in the students. In addition, expert lecturers may also be arranged from outside experts and students may be taken to nearby industrial organisations on visit. Approach extracted reading and handouts may be provided. In addition, different activities like conduct of entrepreneurship awareness camp extension lecturers by outside experts, interactions sessions with entrepreneurs and industrial visits may also be organised. This subject contains five units of equal weightage.

5.3 COMPUTER NETWORKS

L	P
3	4

RATIONALE

Global connectivity can be achieved through computer networks. After completing the diploma, student should have basic understanding of networking and its models. This subject will help the student in network setup and troubleshooting. It will further give exposure to the students about wireless networks and cloud computing.

COURSE OUTCOMES

Upon completion of this subject, students will be able to:

CO1: Learn about the basic concepts of networking models.
CO2: Handle different IP address classes.
CO3: Connect various networking devices.
CO4: Troubleshoot networking related issues.
CO5: Describe wireless networks and cloud computing.

DETAILED CONTENTS

UNIT I

A) BASICS OF NETWORKS

1.1 Concept of network
1.2 Models of network computing
1.3 Networking models
1.4 Peer-to –peer Network
1.5 Client-Server Network
1.6 LAN, MAN and WAN
1.7 Network Services
1.8 Topologies
1.9 Switching Techniques

B) NETWORKING MODELS

1.10 OSI model: Definition, Layered Architecture, Functions of various layers

1.11 TCP/IP Model: Definition, Functions of various layers

1.12 Comparison between OSI and TCP/IP model

UNIT II

TCP/IP ADDRESSING

2.1 Concept of physical and logical addressing

2.2 IPV4 addresses – Address space, Notations

2.3 Classful Addressing- Different IP address classes, Classes & Blocks,

2.4 Net-id & Host-Id,Masks, Address depletion

2.5 Classless Addressing – Address blocks, Masks

2.6 Special IP Addresses

2.7 Subnetting and Supernetting

2.8 Loop back concept

2.9 Network Address Translation

2.10 IPV4 Header

2.11 IPV6 Header

2.12 Comparison between IPV4 and IPV6

UNIT III

A) NETWORK ARCHITECTURE

3.1 Ethernet specification and standardization:

3.2 10 Mbps (Traditional Ethernet),

3.3 10 Mbps(FastEthernet) and

3.4 1000 Mbps (Gigabit Ethernet)

B) NETWORK CONNECTIVITY

3.5 Network connectivity Devices

3.6 NICs

3.7 Hubs, Switches, Routers, Repeaters, Modem, Gateway

3.8 Configuration of Routers & Switches

UNIT IV

NETWORK ADMINISTRATION

4.1 Network Security Principles, Cryptography, using secure protocols
4.2 Trouble Shooting Tools: PING, IPCONFIG, IFCONFIG, NETSTAT,
4.3 TRACEROOT,Wireshark, Nmap, TCPDUMP, ROUTEPRINT
4.4 DHCP Server
4.5 Workgroup/Domain Networking

UNIT V

A) INTRODUCTION TO WIRELESS NETWORKS

5.1 Introduction to wireless LAN IEEE 802.11, WiMax ad Li-Fi
5.2 Wireless Security
5.3 Introduction to bluetooth - architecture, application
5.4 Comparison between bluetooth and Wifi

B) CLOUD COMPUTING

5.5 Definition of Cloud Computing and advantages of Cloud Computing.
5.6 Cloud Computing service model- SaaS, PaaS, Iaas.
5.7 Deployment model-Private Cloud, Public Cloud, Hybrid, Community cloud.

PRACTICAL EXERCISES

1. Recognize the physical topology and cabling (coaxial, OFC, UTP, STP) of anetwork.
2. Recognition and use of various types of connectors RJ-45, RJ-11,BNC andSCST
3. Making of cross cable and straight cable
4. Install and configure a network interface card in a workstation.
5. Identify the IP address of a workstation and the class of the address andconfigure the IP Address on a workstation
6. Managing user accounts in windows.
7. Sharing of Hardware resources in the network.
8. Use of Netstat and its options.
9. Connectivity troubleshooting using PING, IPCONFIG, IFCONFIG
10. Installation of Network Operating System (NOS)
11. Demonstration of Cloud Computing in Labs or using Online Videos.

RECOMMENDED BOOKS

1. Computer Networks by Tanenbaum, Prentice Hall of India, New Delhi.
2. Data Communications and Networking by Forouzan, (Edition 4th),Tata McGraw Hill Education Pvt. Ltd, New Delhi.
3. Data and Computer Communication by William Stallings, Pearson Education, New Delhi.
4. Local Area Networks by Peter Hudson.
5. Network+ Lab manual,- BPB Publications -by Tami Evanson.
6. Cloud Computing by Raj Kumar.

SUGGESTED WEBSITES

http://swayam.gov.in

INSTRUCTIONAL STRATEGY

This is hands on practice based subject and topics taught in the class should be practiced in the Lab regularly for development of required skills among the students. This subject contains five units of equal weightage.

5.4 RELATIONAL DATABASE MANAGEMENT SYSTEM

L	P
3	4

RATIONALE

Database management systems have become an essential component of everyday life in modern society. This course will acquaint the students with the knowledge of fundamental concepts of DBMS and its application in different areas. It will give exposure to the students about storage, manipulation and retrieval of data using query languages like Oracle/My SQL/SQL

COURSE OUTCOMES

Upon completion of this subject, students will be able to:

CO1: Familiarize with the database concepts
CO2: Compile the design of database architecture
CO3: Apply structured Query language
CO4: Respond various queries in the SQL
CO5: Illustrate the nuances of RDBMS

DETAILED CONTENTS

UNIT I

Introduction

1.1 Database Systems; Database and its purpose, Characteristics of the database approach, Advantages and disadvantages of database systems.

1.2 Classification of DBMS Users: Actors on the scene, Database Administrators, Database Designers, End Users, System Analysts and Application Programmers, Workers behind the scene (DBMS system designers and implementers, tool developers, operator and maintenance personnel).

1.3 Data models, schemas, instances, data base state.

1.4 DBMS Architecture: External level, Conceptual level, internal level, Mappings.

1.5 Data Independence: Logical data Independence, Physical data Independence.

1.6 DBMS Language, DBMS Interfaces.

1.7 Classification of DBMS: Centralized, Distributed, parallel and object based.

UNIT II

Data Modeling

2.1 Data Models Classification: File based or primitive models, traditional data models, semantic data models.

2.2 **E.R. Model (Entity Relationship Model):** Entities and Attributes, Entity types and Entity sets, Key attributes and domain of attributes, Relationship among entities. Database design with E/R model.

2.3 **Relational Model**: Concepts, Domain, Attributes, Tuples cardinality, keys (Primary, Secondary, foreign, alternative keys) and Relations. Relational constraints and relational database schemes; Domain constraints, Key constraints and constraints on Null. Relational databases and relational database schemes, Entity integrity, referential integrity and foreign key.

2.4 Comparison b/w E/R model and Relational model.

UNIT III

Normalization Trivial and Non-trivial Dependencies.

3.1 Non-loss decomposition and functional dependencies,

3.2 First, Second and Third normal forms,

3.3 Boyce/Codd normal form,

3.4 Denormalization.

UNIT IV

MYSQL/SQL (Structured Query Language)

4.1 SQL* DDL (Data Definition Languages): Creating Tables, Creating a table with data from another table, Inserting values into a table, updating columns of a Table, Deleting Rows, Droppinga Table.

4.2 DML (Data Manipulation Language): Creating and using indexes, creating and using views

4.3 Database Security and Privileges, Grant and Revoke Command, Maintaining Database Objects, Commit and Rollback,

4.4 various types of select commands, various types of joins, sub query, aggregate functions.

4.5 Challenges of My SQL.

UNIT V
INTERNALS OF RDBMS

5.1 Physical data organization in sequential,
5.2 Index random and hashed files, Parallel and distributed database,
5.3 Transaction Processing,
5.4 Concurrency control and recovery management
5.5 Transaction model properties and state serializability,
5.6 lock based protocols, two phase locking

PRACTICAL EXERCISES

1. Exercises on creation and modification of structure of tables.
2. Exercises on inserting and deleting values from tables.
3. Exercises on views.
4. Exercises on indexes.
5. Exercises on querying the table (using select command).
6. Exercises on using various types of joins.
7. Exercises on using functions provided by database package.
8. Exercises on commands like Grant, Revoke, Commit and Rollback etc.
9. Design of database for inventory control
10. Design of database for library management

RECOMMENDED BOOKS

1. Dr. Renu Vig and Ekta Walia, "Fundamentals of Database Management Systems", an ISTE, Publication, New Delhi.
2. Arun K Majumdar and P Bhattacharya, "Database Management Systems", Tata Mc Graw Hill Education Pvt. Ltd., New Delhi.
3. ISRD Group, "Introduction to DBMS", Tata McGraw Hill Education Pvt. Ltd., New Delhi.
4. Alexis Leon and Mathews Leon, "Database Management Systems", Vikas Publishing House Pvt. Ltd., New Delhi.
5. Date C.J. Adison Wesley, "An Introduction to Database Systems".
6. Elmasri/Navathe/Adison Wesley, "Fundamentals of Database Systems".

7. "SQL Unleashed", Hans Ladanyi Techmedia Publications, New Delhi.
8. SQL, PL/SQL – The Programming Language of Oracle, by Ivan Bayross, BPB Publications, New Delhi
9. e-books/e-tools/relevant software to be us as recommended by AICTE/HSBTE/NITTTR.

SUGGESTED WEBSITES

1. http://swayam.gov.in

INSTRUCTIONAL STRATEGY

This is hands on practice based subject and topics taught in the class should be practiced in the Lab regularly for development of required skills in the students. This subject contains five units of equal weight age. Server can be used as package to explain concepts.

5.5 DEEP LEARNING AND ITS APPLICATIONS

L	P
3	2

RATIONALE

The syllabus on Deep Learning (DL) with CNNs is designed to equip students with foundational knowledge and practical skills in computer vision. Including content on the basics of Convolutional Neural Networks (CNNs) is essential because they are a cornerstone of modern artificial intelligence, particularly in image and video analysis. A foundational knowledge of CNNs provides the necessary background for exploring more advanced neural network architectures and techniques in machine learning and computer vision.

Overall, the syllabus aims to empower students to leverage CNNs effectively in solving real world problems.

COURSE OUTCOMES

Upon completion of this subject, students will be able to:

CO1: Demonstrate a comprehensive understanding of convolutional neural networks (CNNs)

CO2: Apply advanced CNN architectures, for image classification, and object detection.

CO3: Evaluate the performance of CNN models.

CO4: Utilize deep learning frameworks to deploy CNN models.

CO5: Synthesize knowledge from recent research advancements in CNNs

UNIT I

Paradigms in Deep Learning

1.1 Concepts, Significance and Real World Applications

1.2 Machine Learning Vs. Deep Learning

1.3 Introduction to types of Deep Learning Architectures

1.4 Fully Connected Deep Neural Networks(DNN)

1.5 Activation and Loss Functions in DNN

1.6 Performance Metrics in Deep Learning Models

1.7 Introduction to Programming Languages Frameworks for DL: Python, Keras, Tensorflow

UNIT II

Convolutional Neural Network (CNNs)

2.1 Architecture of Convolutional Neural Networks

2.2 Convolution Operations

2.3 Activation Functions in CNN

2.4 Pooling, Flattening and Dropout

2.5 Training Deep Learning Models

2.6 Gradient Descent Approach

2.7 Evaluating, Improving, and Tuning the CNN

2.8 Fine Tuning, Transfer learning and Hyperparameter Tuning

2.9 Introduction to RCNN and Its Applications

UNIT III

Recurrent Neural Networks (RNNs)

3.1 Recurrent Neural Networks (RNNs) and Applications

3.2 Long Short Term Memory (LSTM) Networks, Gated Recurrent Units (GRUs)

3.3 Autoencoders and Applications

3.4 Vanishing Gradient Problem

3.5 Prediction of Timeseries Data using RNN Implementations

UNIT IV

Deep Learning Applications

4.1 Computer Vision : Image classification, Object detection, Image segmentation

4.2 Natural Language Processing (NLP) : Text classification, Sentiment analysis,

4.3 Applications in Healthcare : Disease diagnosis and Drug discovery

4.4 Applications in Finance and Business

PRACTICAL EXERCISES

1. Implementing Classification and Regression using TensorFlow.
2. Build a simple feedforward neural network using TensorFlow.
3. Implement a convolutional neural network (CNN) for image classification using TensorFlow.
4. Implement a recurrent neural network (RNN) for text classification using TensorFlow.
5. Use pre-trained models like VGG or ResNet for image recognition tasks.
6. Implement a Long Short-Term Memory (LSTM) network for time series prediction.
7. Experiment with different hyperparameters (learning rate, batch size, etc.) for a neural network.
8. Train an LSTM network to generate text.
9. Fine-tune a pre-trained language model like BERT for a specific NLP task (e.g., sentiment analysis).

RECOMMENDED BOOKS

1. Dr. Sushma Jaiswal Dr. A. Kumar,Dr. Praveen Kumar Rai,Dr. Gunjan Chhabra, “Fundamental of Neural Network and Deep Learning”.
2. Elena Sterling, “ Deep Learning Handbook: Your Comprehensive Guide to Mastering AI,”.
3. Machine Learning, Deep Learning & Generative AI: Understanding the Complete Modern AI.
4. Deep Learning with Python: The Ultimate Beginners Guide for Deep Learning with Python.
5. Deep Learning with Python: The ultimate beginners guide to Learn Deep Learning with Python Step by Step, Ethan Williams.

INSTRUCTIONAL STRATEGY

This is hands on practice based subject and topics taught in the class should be practiced in the Lab regularly for development of required skills in the students. This subject contains five units of equal weight age.

5.6 SOFTWARE TOOLS FOR AI & ML

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RATIONALE

The goal of designing this syllabus is revolutionizing Software Development with AI and Machine Learning. Software development tools and technologies have seen a vast transformation over the last few years. By leveraging the power of AI and ML, developers can enhance productivity, automate repetitive tasks, and improve the overall software development process. AI tools can also assist teachers in better understanding their students and improving the efficiency of classroom-related tasks.

COURSE OUTCOMES

Upon completion of this subject, students will be able to:

CO1: Gain familiarity with basic Python input/output functions.
CO2: Comprehend the knowledge about the decision-making algorithms.
CO3: Programm various email filtering techniques using Python.
CO4: Imbibe the knowledge about fraud detection techniques
CO5: Develop simple game-playing algorithms, game AI. using Python

DETAILED CONTENTS CUM PRACTICALS

First 6 Exercises are compulsory

1. Guess the Number: A simple game where the user guesses a randomly generated number using basic Python input/output functions.
2. Tic-Tac-Toe AI: Implement a basic Tic-Tac-Toe game with an AI opponent using simple decision-making algorithms.
3. Basic Linear Regression: Create a Python program to perform linear regression on a small dataset, introducing beginners to machine learning concepts.
4. Image Classifier: Build a basic image classifier using a pre-trained model in Python, introducing beginners to image classification with AI.

5. Chatbot: Develop a simple chatbot using Python's NLTK library for natural language processing, allowing beginners to explore conversational AI.
6. Basic Neural Network: Implement a simple neural network from scratch in Python, allowing beginners to understand the basics of artificial neural networks.

Any 5 from the list enlisted below

1. Sentiment Analysis: Write a Python program to perform sentiment analysis on text data, introducing beginners to text classification with AI.
2. Handwritten Digit Recognition: Build a basic digit recognition system using Python and a simple machine learning algorithm, such as K-Nearest Neighbors.
3. Simple Recommender System: Create a basic movie or book recommender system using Python, introducing beginners to recommendation algorithms.
4. Spam Email Filter: Develop a simple spam email filter using Python and basic text classification techniques, providing an introduction to email filtering with AI.
5. Weather Prediction: Build a basic weather prediction model using Python and historical weather data, introducing beginners to time series forecasting with AI.
6. Credit Card Fraud Detection: Develop a basic credit card fraud detection system using Python and simple anomaly detection techniques, introducing beginners to fraud detection with AI.
7. Basic Image Generation: Create a simple program in Python to generate basic images using techniques like random noise generation or simple patterns.
8. Handwriting Recognition: Build a basic handwriting recognition system using Python
9. Simple Game Bot: Develop a bot to play a basic game like Tic-Tac-Toe or Connect Four using Python and simple game-playing algorithms, introducing beginners to game AI.

RECOMMENDED BOOKS

1. "Neural Networks and Deep Learning: A Textbook" by Charu C. Aggarwal, Springer International Publishing
2. "Artificial Intelligence: A Modern Approach" by Stuart Russell and Peter Norvig, Pearson Education Publications
3. "Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow" by Aurélien Géron, Shroff Publishers
4. "Deep Learning" by Ian Goodfellow, Yoshua Bengio, and Aaron Courville

5. "Natural Language Processing with Python" by Steven Bird, Ewan Klein, and Edward Loper, O'Reilly Publishers
6. "Python Machine Learning" by Sebastian Raschka and Vahid Mirjalili, Packt Publishers
7. "Building Machine Learning Powered Applications" by Emmanuel Ameisen, O'Reilly Publishers

INSTRUCTIONAL STRATEGY

This is hands on practice based subject and topics taught in the class should be practiced in the Lab regularly for development of required skills in the students. This subject contains five units of equal weight age.

SIXTH SEMESTER

6.1 BIG DATA ANALYTICS

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RATIONALE

This subject provides an overview of the historical and modern context and operation of Big Data for beginners. It will help the student to study and practice Big Data tools and techniques. By understanding the principles and techniques of big data analytics, students can grasp the intricacies of handling, processing, and deriving insights from massive datasets.. Therefore, the design of a subject dedicated to big data analytics is essential to equip students with the knowledge and skills necessary to excel in this dynamic field.

COURSE OUTCOMES

Upon completion of this subject, students will be able to:

CO1: Provide an overview of an exciting growing field of big data analytics.
CO2: Detail the tools required to manage and analyze big data.
CO3: Illustrate principles in achieving big data analytics with scalability and streaming capability.
CO4: Develop skills to solve complex real- world problems in for decision support.

DETAILED CONTENTS

UNIT I

Overview

Introduction – distributed file system, Big data: definition and taxonomy, Sources of Big Data, characteristics, Benefits of Big Data, Understanding Big Data with Examples. Big data applications, Top 10 industries using Big Data

Big data analytics, Challenges for processing bigdata.

UNIT II

HADOOP

History of Hadoop, Big Data – Apache Hadoop & HadoopEco System. Hadoop Architecture, How Hadoop clusters work, Hadoop Storage: HDFS Introduction, 5 Dameons of Hadoop and their functionalities: NameNode, Secondary NameNode, DataNode, Job Tracker, and Task Tracker.

UNIT III

Map Reduce

MapReduce Introduction, How MapReduce Works, Understanding the Map Reduce architecture - Writing Hadoop MapReduce Word-Count problem - Loading data into HDFS - Executing theMap phase - Shuffling and sorting - Reducing phase execution.

UNIT IV

HADOOP Eco Systems

PIG: What is Pig? Introduction to Pig Data Flow Engine. Pig and MapReduce. When Pig shouldbe used, PIG: The anatomy of Pig , Pig on Hadoop, Pig Philosophy.
Use case for Pig; ETL Processing , Pig Latin overview , Data types in Pig , Running Pig , Execution modes of Pig, HDFS commands, Relational operators, Piggy Bank.
Hive: What is Hive, Architecture of Hive, how Hive Differs from Traditional RDBMS.

PRACTICAL EXERCISES

1. Installation of Hadoop.
2. Setting up a Hadoop cluster.
3. Practice following Hadoop commands touchz,cat,text,get,count,usage.
4. Practice following command of Hadoop:Tail, setrep ,chgrp, chown.
5. Practice following Hadoop commands df , du ,test, mv, getmerge , rmdir.
6. Write a MapReduce program to solve WordCount problem.
7. Write a MapReduce program to solve TeraSort problem.
8. Create a Hive table schema and load data from HDFS into the Hive table. Perform basic data manipulation operations like selecting, filtering, and sorting data using HiveQL queries.

RECOMMENDED BOOKS

1. Boris lublinsky, Kevin t. Smith, Alexey Yakubovich, “Professional Hadoop Solutions”, Wiley, ISBN: 9788126551071, 2015.
2. Chris Eaton, Dirk deroos et al. , “Understanding Big data ”, McGraw Hill, 2012.

3. Tom White, "HADOOP: The definitive Guide", O Reilly 2012.
4. Big Data and Analytics by Seema Acharya and Subhashini Chellappan; Wiley India.
5. The Big Data Revolution : Kindle Edition, by Jason Kolb (Author), Jeremy Kolb.
6. Big Data:Principles and best practices of scalable realtime data systems (Englisch),von Nathan Marz James Warren.
7. Data Mining Methods and Models: Wileyindia ,by Daniel T Larose.
8. Pro Apache Hadoop, 2ed by Sameer Wadkar, Madhu Siddalingaiah, Jason Venner; Wiley india,
9. e-books/e-tools/relevant software to be used as recommended by AICTE/HSBTE/NITTTR.

SUGGESTED WEBSITES

1. http://nptel.ac.in
2. https://ekumbh.aicte-india.org
3. http://swayam.gov.in

INSTRUCTIONAL STRATEGY

This is hands on practice based subject and topics taught in the class should be practiced in the Lab regularly for development of required skills among the students. This subject contains five units of equal weightage.

6.2 AI EXPERT SYSTEMS

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RATIONALE

Expert systems represent a crucial intersection of artificial intelligence and domain-specific knowledge. By encapsulating the expertise of human specialists in various fields, expert systems aim to automate decision-making processes, solve complex problems, and provide valuable insights to users. The design of this subject is rooted in the necessity to harness the wealth of human expertise, make it accessible to a wider audience, and streamline decision-making processes across diverse industries.

COURSE OUTCOMES

Upon completion of this subject, students will be able to:

CO1: Comprehend the concepts of Artificial Intelligence and Expert Systems.
CO2: Display analytical and research abilities.
CO3: Integrate multiple knowledge domains P
CO4: Enhance the Knowledge about the Expert Systems.
CO5: Apply the latest developments and tools in Knowledge systems.

UNIT - I
Introduction
AI Problems – AI techniques – Criteria for success. Problems, Problem Spaces, Search: State space search – Production Systems – Problem Characteristics – Issues in design of Search.

UNIT - II
Heuristic Search techniques
Generate and Test – Hill Climbing – Best-First, Problem Reduction, Constraint Satisfaction, Means-end analysis.

UNIT- III
Knowledge representation issues
Representations and mappings – Approaches to Knowledge representations – Issues in Knowledge representations – Frame Problem.

UNIT - IV

Using Predicate Logic

Representing simple facts in logic – Representing Instance and Isa relationships – Computable functions and predicates – Resolution – Natural deduction.

UNIT - V

Representing knowledge using rules

Procedural Vs Declarative knowledge –Logic programming – Forward Vs Backward reasoning – Matching – Control knowledge Brief explanation of Expert Systems, - Definition- Characteristics- architecture- Knowledge Engineering- Expert System Life Cycle-Knowledge Acquisition Strategies- Expert System Tools.

PRACTICAL EXERCISES

1. Study of PROLOG
2. Write simple fact for the statements using PROLOG

- Ram likes mango.
- Seema is a girl.
- Bill likes Cindy.
- Rose is red.
- John owns gold.

3. Write predicates, one converts centigrade temperatures to Fahrenheit, the other checks if a temperature is below freezing using PROLOG
4. Write a program to solve the Monkey Banana problem using PROLOG
5. WAP in turbo PROLOG program for medical diagnosis and show the advantage and disadvantage of green and red cuts.
6. WAP to implement factorial, Fibonacci of a given number using PROLOG.
7. Write a program to solve 4-Queen problem using PROLOG and Python both.
8. Write a program to solve traveling salesman problem using PROLOG.
9. Write a program to solve water jug problem using LISP and Python both.
10. Write a python program to implement Breadth First Search Traversal.
11. Write a program to implement Tic-Tac-Toe game using Python.

RECOMMENDED BOOKS

1. Stuart Russell & Peter Norvig, "Artificial Intelligence A Modern Approach", Perason,2nd Edition.
2. George F Luger, "Artificial Intelligence", Pearson 2002, 4th Edition.
3. V S Janaki Raman, K Sarukesi, P Gopalakrishnan, "Foundations of Artificial Intelligentand Expert Systems", MacMillan India limited.

SUGGESTED WEBSITES

1. http://nptel.ac.in
2. https://ekumbh.aicte-india.org
3. http://swayam.gov.in

INSTRUCTIONAL STRATEGY

This is hands on practice based subject and topics taught in the class should be practiced in the Lab regularly for development of required skills among the students. This subject contains five units of equal weightage.

6.3 PROGRAMME ELECTIVE - II
6.3.1 FUZZY LOGIC AND APPLICATIONS

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RATIONALE

The rationale for defining the syllabus of the subject of fuzzy logic and its applications lies in its growing significance in various fields such as artificial intelligence, control systems, decision-making, and pattern recognition. Fuzzy logic provides a framework for handling uncertainty and imprecision, which are prevalent in real-world scenarios. A well-defined syllabus ensures that students gain a comprehensive understanding of fuzzy logic theories, methodologies, and practical applications, enabling them to contribute meaningfully to advancements in technology and decision-making processes.

COURSE OUTCOMES

Upon completion of this subject, students will be able to:

CO1: Elaborate the basics of fuzzy logic
CO2: Illustrate different operations based on fuzzy sets
CO3: Acquire knowledge regarding different qualifiers and relations.
CO4: Implement different applications based on fuzzy logic.

DETAILED CONTENTS

UNIT II
Fundamentals Of Fuzzy Logic

Basic concepts: Introduction to fuzzy sets, characteristics, requirements, fuzzy set theory- basic concept of crisp sets and fuzzy sets, Classical and Fuzzy Sets, Overview of Classical Sets, Membership Function.

UNIT-2
Fuzzy Arithmetic

Fuzzy Operations: Complements- union intersection- combination of operation- general aggregation operations. Fuzzy Arithmetic: Fuzzy Numbers, Linguistic Variables, Arithmetic Operations on intervals & Numbers, a-cuts, Properties of a-cuts, Decomposition Theorems, Extension Principle.

UNIT III

Fuzzy Relations

Fuzzy Relations: Crisp & Fuzzy Relations, Projections & Cylindric Extensions, Binary Fuzzy Relations, Binary Relations on single set, Equivalence, Compatibility & Ordering Relations, Morphisms, Fuzzy Relation Equations.

UNIT IV

Fuzzy Qualifiers

Possibility Theory: Fuzzy Measures, Evidence & Possibility Theory, Possibility versus Probability Theory. Fuzzy Logic: Classical Logic, Multivalued Logics, Fuzzy Propositions, Fuzzy Qualifiers, Linguistic Hedges.

UINIT V

Applications Of Fuzzy Logic

Aerospace and Automotive systems, business, defense, electronics devices, finance and industrial sector, manufacturing, medical, securities, pattern recognition and classification.

RECOMMENDED BOOKS

1. A Learner's Guide to Fuzzy Logic Systems, Second Edition ,By K Sundareswaran
2. Principles of Soft Computing by Dr S N Sivanandam and Dr S N Deepa
3. "Fuzzy Logic with Engineering Applications" by Timothy J. Ross.
4. "Fuzzy Logic: Intelligence, Control, and Information" by John Yen and Reza Langari
5. "Fuzzy Systems Theory and Its Applications By Toshiro Terano

SUGGESTED WEBSITES

1. http://nptel.ac.in
2. https://ekumbh.aicte-india.org
3. http://swayam.gov.in

INSTRUCTIONAL STRATEGY

This is a subject providing disruptive technologies exposure to the students, teachers should teach the subject giving real time examples in the class and some practice examples should be demonstrated to the students in the class. This subject contains five units of equal weightage.

6.3.2 NETWORK AND INFORMATION SECURITY

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RATIONALE

Computer network security is an important aspect in today's world. Now days due to various threats designing security in organization is an important consideration. It is essential to understand basic security principles, various threats to security and techniques to address these threats. The student will be able to recognize potential threats to confidentiality, integrity and availability and also able to implement various computer security policies. This course will introduce basic cryptographic techniques, fundamentals of computer/network security, Risks faced by computers and networks, security mechanisms, operating system security, secure System design principles, and network security principles. Also it will create awareness about IT ACT and different Cyber laws.

COURSE OUTCOMES

Upon completion of this subject, students will be able to:

CO1: Demonstrate a thorough understanding of various network threats and vulnerabilities.
CO2: Acquire the skills necessary to design, implement, and maintain effective network defense mechanisms.
CO3: Develop an awareness of the ethical and legal implications associated with network security practices.
CO4: Analyze network security incidents, identify their root causes, and formulate appropriate response strategies.

DETAILED CONTENTS

UNIT I
Introduction to Computer and Information Security

1.1 Definition and Need of computer security,
1.2 Security Basics: Confidentiality, Integrity, Availability, Accountability, Non Repudiation and Reliability.

1.3 Risk and Threat Analysis: Assets, Vulnerability Threats, Risks Counter measures.

1.4 Threat to Security: Viruses, Phases of Viruses, Types of viruses, Dealing with viruses, Worms, Trojan horse Intruders, Insiders.

1.5 Information, Need and Importance of information, security, Basic Principles of information security.

UNIT II
User Authentication and Access Control

2.1 Identification and Authentication: User name and Password, Guessing Password, Password attacks: Piggybacking, Shoulder surfing, Dumpster diving.

2.2 Biometrics: Finger Prints. Hand Prints, Retina Patterns, Voice patterns, Signature and Writing patterns, Keystrokes.

2.3 Access Controls: Definition, Authentication Mechanism, Principle-Authentication, Authorization, Audit, Policies: DAC, MAC, RBAC.

UNIT III
Cryptography

3.1 Introduction: Plain Text, Cipher Text, Cryptography, Cryptanalysis, Cryptology, encryption, Decryption.

3.2 Substitution Techniques: Caesar's cipher, Modified Caesar's cipher, Transposition Techniques: Simple Columnar Transposition.

3.3 Symmetric and Asymmetric cryptography: Introduction to Symmetric encryption, DES(Data Encryption standard) algorithm, Asymmetric key cryptography: Digital Signature.

3.4 Digital Signatures, Digital certification, IPSec

UNIT IV
Firewall and Intrusion Detection System

4.1 Firewall: Need of firewall, types of firewall- Packet Filters, Stateful Packet Filters, application Gateways, circuit Gateways.

4.2 Firewall Policies, Configuration, limitations, DMZ

4.3 Intrusion Detection System, Vulnerability Assessment, Misuse detection, Anomaly Detection, Network-Based IDS, Host based IDS, Honeypots.

UNIT V
Network Security, Cyber Laws and Compliance Standards

5.1 IP Security- Overview, Protocols- AH, ESP, Modes- Transport and Tunnel.
5.2 Email security- SMPT, PEM, PGP.
5.3 Public Key Infrastructure (PKI): Introduction, Certificates, Certificate authority, Registration Authority, X.509/PKIX certificate format.
5.4 Cyber Crime: Introduction, Hacking, Digital Forgery, Cyber Stalking/Harassment, Identify Theft and Fraud, Cyber terrorism, Cyber Defamation
5.5 Cyber laws: Introduction, Need, Categories': Crime against individual, Government, property.
5.6 Compliance Standards: Implementing and Information Security Management system, ISO 27001, ISO 20000, BS 25999, PCI DSS, ITIL framework, COBIT framework.

RECOMMENDED BOOKS

1. Computer Security by Dieter Gollmann: Wiley Publication, New Delhi
2. Cryptography and Network Security by Atul Kahate, McGraw Hill Education, New Delhi
3. Cyber Laws and IT Protection by Harish Chander, PHI Publication, New Delhi
4. Cryptography and Network Security by Forouzon; Tata McGraw Hill Education Pvt Ltd, NewDelhi.
5. Cryptography and Network Security by Padmanabham; Wiley India Pvt Ltd. Daryaganj, NewDelhi.
6. Network Security by Eric Cole, Bible; Wiley India Pvt Ltd. Daryaganj, New Delhi.
7. Network Security by William Stalling.
8. e-books/e-tools/relevant software to be used as recommended by AICTE/HSBTE/NITTTR.

SUGGESTED WEBSITES

1. http://nptel.ac.in
2. https://ekumbh.aicte-india.org
3. http://swayam.gov.in

INSTRUCTIONAL STRATEGY

This is a subject providing disruptive technologies exposure to the students, teachers should teach the subject giving real time examples in the class and some practice examples should be demonstrated to the students in the class. This subject contains five units of equal weightage.

6.3.3 DATA WAREHOUSING AND DATA MINING

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RATIONALE

Data mining and warehousing are pivotal elements of decision support systems in contemporary industry and business. These methodologies empower students to make more informed and expedited decisions. The aim of this course is to acquaint students with a variety of concepts and methodologies in Data Mining and Data Warehousing. This course covers principles, algorithms, structure, design, and execution of data mining and data warehousing techniques. Acquiring knowledge in this course would enhance the career prospects of students in the information management sector.

COURSE OUTCOMES

Upon completion of this subject, students will be able to:

At the end of this subject, the students will be able to:

CO1: Acquire the basic knowledge of data warehousing and mining.
CO2: Illustrate the basic use of OLAP, MOLAP and ROLAP servers.
CO3: Learn about usage of warehouses according to business perspective.
CO4: Elaborate the advanced concepts of data mining and learn how to use these concepts.

DETAILED CONTENTS

UNIT I
Introduction to Data warehouse

1.1 Data warehouse characteristics.
1.2 Difference between operational database systems and data warehouses, Data warehouse functions, requirements
1.3 Data Warehouse Models-Different Enterprise warehouse Models
1.4 Data Mart, and Virtual Warehouse, Meta repositories.
1.5 Benefits and Applications of data warehousing

UNIT II

Data warehouse Architecture and its Components

2.1 Extraction- Transformation-Loading, Logical (Multi-Dimensional)

2.2 Data Modeling, Schema Design, Star and Snow- Flake Schema Fact Constellation, Fact Table

2.3 OLAP Cube, OLAP Operations, OLAP Server Architecture ROLAP, MOLAP and HOLAP.

2.4 Data Warehouse Implementation -Efficient Data Cube Computation: An Overview.

2.5 Indexing OLAP Data: Bitmap Index and Join Index, Efficient Processing of OLAP Queries OLAP Server Architectures: ROLAP Versus MOLAP versus HOLAP

UNIT III

Introduction to Data Mining

3.1 Data Mining Functionalities, Classification of Data Mining systems

3.2 Data Mining Task Primitives, Integration of a Data Mining System with a Database or Data Warehouse System.

3.3 Major issues in Data Mining. Data Preprocessing: Need for Preprocessing the Data.

3.4 Data Integration & Transformation, Data Reduction

3.5 Discretization and Concept Hierarchy Generation.

UNIT IV

Fundamentals of Data Mining

4.1 Mining Steps in the process of knowledge discovery of Database (KDD) .

4.2 Types of data required mining, Major issues in data mining

4.3 Data Objects and Attributes types.

4.4 Data Preprocessing: need of preprocessing, Major Tasks in Data Preprocessing.

4.5 Data Cleaning: Missing values, Noisydata, Data cleaning as a process.

UNIT V

5.1 Mining Frequent Patterns: Basic Concepts: Market Basket Analysis, Frequent item sets, Closed item sets, and Association Rules

5.2 Frequent Itemset Mining Methods: The Apriori Algorithm, Finding Frequent item sets Using Candidate Generation.

5.3 Generating Association Rules from Frequent item sets.

5.4 Cluster Analysis- Requirements for Cluster Analysis

5.5 Overview of Basic Clustering Methods, General Applications of Clustering.

RECOMMENDED BOOKS

1. Data Mining Techniques, Arun K Pujari, 3rd Edition, Universities Press.
2. Data Warehousing Fundamental's, Paulraj Ponniah, Wiley Student Edition.
3. "Data Mining: Concepts and Techniques" by Jiawei Han, Micheline Kamber, and Jian Pei.
4. Database Systems: Introduction to Databases and Data Warehouses
5. Dr. Renu Vig and Ekta Walia, “Fundamentals of Database Management Systems”, an ISTE, Publication, New Delhi.
6. Arun K Majumdar and P Bhattacharya, “Database Management Systems”, Tata Mc Graw Hill Education Pvt. Ltd., New Delhi.

SUGGESTED WEBSITES

1. http://nptel.ac.in
2. https://ekumbh.aicte-india.org
3. http://swayam.gov.in

INSTRUCTIONAL STRATEGY

This is a subject providing disruptive technologies exposure to the students, teachers should teach the subject giving real time examples in the class and some practice examples should be demonstrated to the students in the class. This subject contains five units of equal weightage.

6.4 MULTIDISCIPLINARY ELECTIVE

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RATIONALE

Multidisciplinary electives are very important and play major role in implementation of National Education Policy. Multidisciplinary is a subject which is useful for two or more disciplines in which students are asked to understand the concept of multidisciplinary or interdisciplinary. It will help the students to gain an arsenal of skills that are easily transferable across work environments.

COURSE OUTCOMES

At the end of the multidisciplinary elective, the students will be able to:

CO1: Apply critical thinking in problem solving.
CO2: Demonstrate self and time management.
CO3: Display analytical and research abilities.
CO4: Integrate multiple knowledge domains.
CO5: Enhance the scope and depth of learning.

LIST OF MULTIDISCIPLINARY ELECTIVES

(The list is indicative and not exhaustive)

1. Introduction to Internet of Things
2. Introduction to Robotics
3. Introduction to Embedded System Design
4. Fundamentals of Artificial Intelligence
5. Introduction to Machine Learning
6. The Joy of Computing Using Python

7. Introduction to Industry 4.0
8. Industrial Internet of Things
9. Object Oriented System Development using UML, Java and Patterns
10. Digital Marketing
11. Artificial Intelligence Marketing Professional

GUIDELINES

Multidisciplinary Elective shall be offered preferably in online mode. Online mode multidisciplinary elective shall preferably be through Massive Open Online Courses (MOOCs) from Swayam, NPTEL, Upgrad, Udemy, KhanAcademy or any other online portal to promote self-learning. A flexible basket of large number of multidisciplinary electives is suggested which can be modified depending upon the availability of courses at suggested portals and requirements. For online multidisciplinary electives, department coordinators shall be assigned to monitor and guide the group of students for selection of minimum 20 hours duration online course of their choice. For offline multidisciplinary electives, a suitable relevant subject shall be offered by the respective department to the students with minimum 40% of the total class strength as per present and future requirements.
Assessment of MOOCs multidisciplinary elective shall be based on continuous evaluation by the respective coordinator. The coordinator shall consider the submitted assignments by the students from time to time during the conduct of MOOCs. The MOOCs assessment shall be conducted by the coordinator along with one external expert by considering submitted assignments out of 100 marks.

In case, no suitable multidisciplinary elective is available online, only then the course may be conducted in offline mode. The assessment of offline multidisciplinary elective shall be internal and external. The offline multidisciplinary elective internal assessment of 40 marks shall be based on internal sessional tests, assignments etc. and external assessment of 60 marks shall be based on external examination at institute level.

SUGGESTED WEBSITES

1. https://swayam.gov.in/
2. https://www.udemy.com/
3. https://www.upgrad.com/
4. https://www.khanacademy.org/

6.5 Major Project/ Industrial Training

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RATIONALE

Industrial Internship / Major project work will help in developing the relevant skills among the students as per National Skill Qualification Framework. It aims at exposing the students to the present and future needs of various relevant industries. It is expected from the students to get acquainted with desired attributes for industrial environment. For this purpose, students are required to be involved in industrial training / Major Project Work in different establishments.

COURSE OUTCOMES

After undergoing this course, the students will be able to:

CO1: Define the problem statement of the Industrial training / Major project according to the need of industry.

CO2: Work as a team member for successful completion of Industrial training / Major project.

CO3: Write the Major project report effectively.

CO4: Present the Major project report using PPT.

GUIDELINES

Depending upon the interest of the students, they can go for Major project/ Industrial training as per present and future demand of the industry. The supervisors may guide the students to identify their project work and chalk out their plan of action well in advance. As Major project / Industrial training activity each student is supposed to study the operations at site and prepare a detailed project report of the observations/processes/activities. The supervisor may create agroup of 4-5 students as per their interest to work as a team for successful completion of the / Major Project/ Industrial training.

The supervisor shall evaluate the students along with one external industry / academic expert by considering the following parameters:

	Parameter	**Weightage**
I	Defining problem statement, focus and approach	20%
ii	Innovation / creativity	20%
iii	Report Writing	20%
iv	Power Point Presentation	20%
v	Viva - voce	20%

24. ASSESMENT TOOLS AND CRITERION

The assessment is carried out by conducting:

1. Formative assessments
2. Summative assessments

1. FORMATIVE ASSESSEMENT

The **formative assessment** will be evaluated on the basis of the internal assessments for theory subjects and practical by the concerned teachers for evaluating the knowledge and skill acquired by students and the behavioral transformation of the students. This **internal assessment** is primarily carried out by collecting evidence of competence gained by the students by evaluating them at work based on assessment criteria, asking questions and initiating formative discussions to assess understanding and by evaluating records and reports, and sessional marks are awarded to them.

2. SUMMATIVE ASSESSMENT

The **summative assessment** will include end semester examination for theory part for each candidate and practical examination with viva voice. Each Performance Criteria will be assigned marks proportional to its importance and proportion of marks for Theory and Skills Practical for each subject should be laid down.

The following assessment tools are used for effective student evaluation:

1. Theory Examinations
2. Practical Work
3. Internships
4. Professional Industrial Training
5. Project Work (Minor & Major)
6. Massive Open Online Courses (MOOCs)
7. Viva Voce
8. Case Studies

1. Theory

Evaluation in theory aims at assessing students' understanding of concepts, principles and procedures related to a course/subject, and their ability to apply learnt principles and solve problems.

The **formative evaluation** for theory subjects may be caused through

i. Sessional /class-tests,
ii. Quizzes,
iii. Assignments,
iv. Seminars/ Presentations
v. Attendance
vi. Case Studies

For **Summative evaluation** of theory, the question paper may comprise of three sections.

i. It should contain objective type question and multiple choice questions. The objective type items should be used to evaluate students' performance in knowledge, comprehension and at the most application domains only.
ii. It should contain short answer questions.
iii. Descriptive type questions , with some internal choice of the questions set may be given in this section

2. Practical Assessment

Evaluation of students performance in practical work (Laboratory experiments, Workshop practical /field exercises) aims at assessing students ability to apply or practice the concepts, principles and procedures, manipulative skills, ability to observe and record, ability to interpret and draw conclusions and work related attitudes. This will comprise of a creation of mock environment, wherever applicable in the skill lab which is equipped with all required equipment for development of desired skills. Candidate's soft skills, communication, aptitude, safety consciousness, quality consciousness etc. will be ascertained by observation and will be marked in observation checklist along with the assessment of Job carried out in labs and maintenance of Lab Record files.

Formative and summative evaluation may comprise of weightages to performance on task, quality of product, general behavior and it should be followed by viva-voce of the relevant subject. The end product will be measured against the specified dimensions and standards to gauge the level of his skill achievements

3. Internship

The two mandatory internships after I Year and II Year of the programme are to be assessed in 3rd and 5th semester subsequently. The internships should be preferably done in the field/ in the industry, can be in house depending upon the stream and availability of resources in and around the institute.

Every faculty should be assigned the students and made responsible for the evaluation and assessment of the internship. Formative assessment should be taken from the industry/institute/ department on the basis of performance, behavior and learning capabilities. Summative evaluation may comprise of weightages on the basis of report submission/ presentation followed by viva-voce of the relevant subject.

4. Professional Industrial Training

Evaluation of professional industrial training report and viva-voce/ presentation aims at assessing students' understanding of industrial processes, practices in the industry/field and their ability to engage in activities related to problem-solving in industrial setting as well as understanding of application of learnt knowledge and skills in real life situation. Formative and summative evaluation may comprise of weightages to performance on task, quality of product, general behavior and it should be followed by viva-voce of the relevant subject.

The formative assessment should include the evaluation from the employer where the student is doing his training or Project work in the ratio of 40:60. The final assessment will be the combination of the employer assessment and evaluation by the faculty of the institute which shall include report submission/ presentation/ seminar followed by viva-voce of the relevant subject.

5. Project Work Assessment

The purpose of evaluation of project work is to assess student's ability to apply, in an integrated manner, knowledge and skills in solving real life problems, manipulative skills, ability to observe, record, creativity and communication skills. The project work assigned should be of

relevance to the core skill, state of the art topics and the project areas that are pertaining to enhance job skill and enhance occupational opportunities. For both, minor and major project, Formative and summative evaluation may comprise of weightages to performance on task, quality of product, nature and relevance of project and general behavior.
The formative assessment should include the continuous assessment based on the work allocated and mid semester viva voice or presentation. The final assessment will be the combination of the project undertaken, report submission and should be followed by viva-voce of the relevant subject.

In case of the assessment of this component, the team of examiners should be constituted on 50 – 50 % basis. i.e. half of the examiners in the team should be invited from outside the institute conducting examination.

6. MOOC COURSES (Open Elective and Multi-Disciplinary Elective)

Massive Open Online Courses (MOOCs) platforms promise open, online courses to massive numbers of students as they are free to join, they provide a wide range of courses, they allow for space and time flexibility and their participants can benefit from various online communication tools and access to quality content.

The coordinating Department/Centre/Office shall monitor every student to adopt the courses online of their choice and preference on Swayam portal. The duration of courses will vary depending on the level and credit points. Courses offered in the duration of 4-10 weeks for 2 to 3 credits at diploma level are to be opted. Students, after they have registered, can get a certificate after attending the classes and submitting the assignments/quizzes and qualifying nationwide exam conducted written exam at the institute close to the one where the student is enrolled.

On successful completion of each course, the institution offering the MOOCs course would issue the certificate, along with the number of credits and grades, through which the student can get credits transferred into his marks certificate issued by his parent institution. Guidelines for credit sharing will be issued by concerned Regulators such as UGC, AICTE, etc. for consideration by various Institutes. There may be standard norms for the host Institution to conduct the course that may include continuous evaluation through assignments, online quizzes, case studies, online writing exercises, term examinations, student feedback, online forum management, etc.

The coordinating Department/Centre/Office of the respective department shall monitor every student and submit to the Office of Examinations, a score sheet (marks card) during the last 10 days prior to the close of the even semester.

7. Viva Voce

This tool will be used to assess the conceptual understanding and the behavioral aspects as regards the job role and the specific task at hand. It will also include questions on safety, quality, environment and equipment's etc. Ask questions on non-prescribed tasks to ensure that the learners have complete knowledge on the assessment

Computation of SGPA and CGPA

The UGC recommends the following procedure to compute the Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA):

i. The SGPA is the ratio of sum of the product of the number of credits with the marks scored by a student in all the courses taken by a student and the sum of the number of credits of all the courses undergone by a student, i.e

$$SGPA\ (Si) = \sum(Ci \times Gi) / \sum Ci$$

where Ci is the number of credits of the ith course and Gi is the marks scored by the student in the ith course.

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

$$CGPA = \sum(Ci \times Si) / \sum Ci$$

where Si is the SGPA of the ith semester and Ci is the total number of credits in that semester.

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

25. TEACHING LEARNING TOOLS FOR EFFECTIVE IMPLEMENTATION

For effective implementation of curriculum, the faculty and staff of institutions have to play a vital role in planning instructional experiences for the courses in four different environments viz. class-room, laboratory, library and field and execute them in right perspective. It is emphasized that only a proper mix of different teaching methods in all these places of instruction can bring the changes in students behavior as stipulated in the curriculum document. It is important to understand curriculum document holistically and further be aware of intricacies of Teaching-Learning Tools for achieving curriculum objectives. Given below are certain recommendations which may help in carrying out teaching-learning effectively:

PROGRAMME LEVEL RECOMMENDATIONS

1. Curriculum implementation takes place at programme, course and class-room level respectively and synchronization among them is required for its success. The first step towards achieving synchronization is to read curriculum document holistically and understand its rationale and philosophy.

2. An academic plan needs to be prepared at institute level. The Head of the institute have a great role to play in its dissemination and percolation up to grass-root level.

3. Head of Department are required to prepare academic plan at department level referring to institutional academic plan.

COURSE LEVEL RECOMMENDATIONS

Teachers are educational managers at class room level and their success in achieving course level objectives lies in using course plan and their judicious execution which is very important for the success of programme by achieving its objectives. Teachers are required to plan various instructional experiences viz. theory lecture, expert lectures, lab/workshop practicals, guided library exercises, field visits, study tours, camps etc. In addition, they have to carry out progressive assessment of theory, assignments, library, practicals and field experiences. Teachers are also required to do all these activities within a stipulated period which is made available to them in the academic plan at Board level. With the amount of time to their credit, it is essential for them to use it judiciously by planning all above activities properly and ensure execution of

the plan effectively. Following is the gist of suggestions for subject teachers for effective utilization of Teaching Learning Tools to achieve the course objectives:

1. Teachers need to ensure attainment of course outcomes so as to help the students achieve program outcomes and also meet the desired learning outcomes in five domains of NSQF i.e. Process, Professional knowledge, Professional skills, Core skills and Responsibility.

2. Teachers are required to prepare a course plan, taking into account number of weeks available and courses to be taught.

3. Teachers are required to prepare lesson plan for every theory class. This plan may comprise of contents to be covered, learning material for execution of a lesson plan.

4. Teachers are required to plan for expert lectures from field/industry. For this, necessary steps need to be taken such as planning in advance, identifying field experts, making correspondence to invite them, taking necessary budgetary approval etc.

5. Teachers are required to plan for guided library exercises by identification of course specific experience requirement, setting time, assessment, etc. The assignments and seminars can be thought of as terminal outcome of library experiences.

6. Concept based industrial/field visits may be planned and executed for such contents of course which are abstract in nature and no other requisite resources are readily available in institute to impart them effectively.

7. Lot of focus needs to be laid on skill development. There is need for planning practical experiences in right perspective. These slots in a course are the avenues to use problem based learning and experiential learning effectively. The development and use of lab manuals will enable the institutes to provide lab experiences effectively.

8. Emphasis should to lay on developing soft skills like communication skills, personality Development, self-learning, inter personal skills, problem solving, and creativity etc.

9. Where ever possible, it is essential to use activity based learning rather than relying on delivery based conventional teaching all the time. While teaching, the teacher should make extensive use of audio visual aids such as video films, power point presentations and IT tools.

10. Teachers may take initiative in establishing liaison with industries and field organizations for imparting field experiences to their students.

11. Students be made aware about issues related to ecology and environment, safety, concern f for wastage of energy and other resources etc.

12. To enhance digital learning, open electives and multi-disciplinary electives have been provided in the curriculum to be taken up in the form of MOOCs. For Open electives, some courses may be identified out of the prescribed list given in the curriculum keeping in mind the interest of students. Similarly, for multi-disciplinary electives, courses to be o offered may be identified by considering their relevance and utility. Every year SWAYAM is notifying the list of courses which are going to be offered in forthcoming even and odd semester. The institute needs to select the courses that are offered on SWAYAM platform or any other online platform.

13. For effective implementation of Massive Open Online Courses (MOOCs), a faculty member in the department may be identified and given the responsibility to coordinate various activities related to MOOCs. The concerned faculty member will facilitate in registration of students for MOOCs. The faculty member will also be responsible for compiling the result of students on the completion of MOOCs and pass on the information to the concerned authority.

14. Flexibility has been provided in the curriculum for the students to choose a course related to the discipline as per their interest. For effective implementation of discipline-specific electives, the institute should identify some courses from the list of courses prescribed in the curriculum. The courses should be selected and offered keeping in mind the interest of students, infrastructure and expertise available in and around the institute related to the courses. Option for discipline-specific elective may be taken from students through a form and a course, with more than 10 students opting for it, may be run.

15. Where ever possible, it is essential to use activity based learning rather than relying on delivery based conventional teaching all the time. While teaching, the teacher should make extensive use of audio visual aids such as video films, power point presentations and IT tools.

16. Teachers may take initiative in establishing liaison with industries and field organizations for imparting field experiences to their students.

17. Students be made aware about issues related to ecology and environment, safety, concern for wastage of energy and other resources etc.

18. To enhance digital learning, open electives and multi-disciplinary electives have been provided in the curriculum to be taken up in the form of MOOCs. For Open electives, some courses may be identified out of the prescribed list given in the curriculum keeping in mind the interest of students. Similarly, for multi-disciplinary electives, courses to be offered may be identified by considering their relevance and utility. Every year SWAYAM is notifying the list of courses which are going to be offered in forthcoming even and odd semester. The institute needs to select the courses that are offered on SWAYAM platform or any other online platform.

26. LIST OF EXPERTS

1. Controller of Examination, Haryana State Board of Technical Education, Panchkula.
2. Controller of Admn. & Finance, Haryana State Board of Technical Education, Panchkula.
3. Joint Secretary, Haryana State Board of Technical Education, Panchkula.
4. Deputy Secretary, Training & Placement, Haryana State Board of Technical Education, Panchkula.
5. Deputy Secretary, Examination, Haryana State Board of Technical Education, Panchkula.
6. Deputy Secretary, Academic, Haryana State Board of Technical Education, Panchkula.
7. Assistant Secretary, Academic, Haryana State Board of Technical Education, Panchkula.
8. Sh. Hitesh Kumar, Deputy Secretary (T & P), Haryana State Board of Technical Education, Panchkula.
9. Sh. Munish Gupta, HOD, Government Polytechnic, Ambala.
10. Sh. Sanjeev Sehgal, HOD, Seth Jai Parkash Polytechnic, Damla.
11. Sh. Mandeep Singh, Lecturer, Seth Jai Parkash Polytechnic, Damla.
12. Sh. Rohit Mandhar, Lecturer, Seth Jai Parkash Polytechnic, Damla.
13. Smt. Sucheta Mor, DPG, Polytechnic Gurgaon.
14. Ms. Palak Kalsi, DPG, Polytechnic Gurgaon.
15. Sh. Rajesh Garg, Lecturer, Seth Jai Parkash Polytechnic, Damla.
16. Sh. Sanjay Puri, Lecturer, Seth Jai Parkash Polytechnic, Damla.
17. Sh. Ravinder Singh Punia, Lecturer, Government Polytechnic, Ambala.
18. Dr. Vipin Kumar, Lecturer, Seth Jai Parkash Polytechnic, Damla.
19. Smt. Reshma Yadav, DPG Polytechnic Gurgaon.

20. Dr. Gaurav Kumar, Director, Magma Research and Consultancy Services.

21. Mani Madhukar, The International Business Machines Corporation (IBM).

22. Dr. Sarabjeet Singh, Professor, CSE, PEC, UIET, Panjab University, Chandigarh.

23. Dr. Pardeep Kumar Singh, Professor and Associate Dean, SVKM's NMIMS Deemed to be University, Chandigarh Campus.

24. Dr. Mala Kalra, Faculty, NITTTR, Chandigarh.

25. Dr. Shimmi, Faculty, NITTTR, Chandigarh.

26. Dr. Rangachar Bhardwaj, Project Engieer, MV Drives, R&D, ABB India, Bangalore.

27. Smt. Pushpa Rani, Senior Lecturer, Applied Science Department, Government Polytechnic, Sonipat, Haryana.

28. Smt. Krishna Bhoria, Lecturer, Applied Science Department, Government Polytechnic, Ambala, Haryana.

29. Smt. Preetpal Kaur, Guest Faculty, Applied Science Department, Government Polytechnic, Ambala, Haryana.
30. Ms. Monika, Lecturer, Applied Science Department, Seth Jai Parkash Polytechnic, Damla, Haryana.
31. Dr. Neena Sharma, English Department, MCM College, Chandigarh.

32. Dr. Bhajan Lal, Lecturer, Applied Science Department, Government Polytechnic, Sirsa, Haryana.
33. Sh. Anil Nain, Lecturer, Applied Science Department, Government Polytechnic, Hisar, Haryana.
34. Dr. Sarita Mann, Lecturer, Applied Science Department, Government Polytechnic, Ambala, Haryana.
35. Smt. Bindu Verma, Lecturer, Applied Science Department, Seth Jai Parkash Polytechnic, Damla, Haryana.
36. Mr. Satyawan Dhaka, Senior Lecturer, Applied Science Department, Government Polytechnic, Nilokheri.

37. Mrs. Sapna Sang, Lecturer, Applied Science Department, Seth Jai Parkash Polytechnic, Damla.
38. Mr. Ravi Bansal, Lecturer, Applied Science Department, Government Polytechnic, Manesar.
39. Mrs. Kiran, Lecturer, Applied Science Department, Government Polytechnic, Sonepat.
40. Dr. Naveen Jha, Assistant Professor, Department of Mathematics, Government Engineering College, Bharatpur.
41. Dr. Vidhi Grover, Lecturer, Applied Science Department, Seth Jai Parkash Polytechnic, Damla.
42. Mr. Tavinder Singh, Lecturer, Applied Science Department, Government Polytechnic, Sirsa.
43. Ms. Sunita Rani, Lecturer, Applied Science Department, Government Polytechnic, Ambala.
44. Mr. Subhash Chandra Bhoria, Senior Lecturer, Mechanical Engineering Department, Government Polytechnic, Hisar.
45. Mr. Jagjit Singh Narang, Senior Lecturer, Mechanical Engineering Department, Government Polytechnic, Ambala.
46. Mr. Pardeep Kumar, Senior Lecturer, Mechanical Engineering Department, Government Polytechnic, Nilokheri.
47. Dr. Pankaj Sharma, Professor, Applied Science Department, NITTTR, Chandigarh.
48. Dr. Ashok Kumar, Associate Professor, Applied Science Department, NITTTR, Chandigarh.
49. Mr. KG Srinivasa, Professor, Information Management & Emerging Engineering, NITTTR, Chandigarh.
50. Dr. Ritula, Faculty, Associate Professor, Electrical Engineering Department, Chandigarh.
51. Dr. KC Lachhwani, Assistant Professor, Applied Science, NITTTR, Chandigarh
52. Dr. Rajesh Mehra, Professor and Head, Curriculum Development Centre, NITTTR, Chandigarh.
53. Dr. AB Gupta, Professor and Head, , NITTTR, Chandigarh. Education & Educational

Management Department,

54. Sh. PK Singla, Associate Professor, Curriculum Development Centre NITTTR, Chandigarh.
55. Dr. SK Gupta, Associate Professor, Curriculum Development Centre, NITTTR, Chandigarh.
56. Dr. Meenakshi Sood, Associate Professor, Curriculum Development Centre, NITTTR, Chandigarh.

Coordinator

27. APPENDIX

Sr. No.	LIST OF EQUIPMENT
1.	Computer Systems
2.	Network Switch
3.	Connectors (RJ-45,) Cables: (UTP,STP)
4.	Multifunction Printer
5.	Colour Laser Printer
6.	Router
7.	Antivirus
8.	Java
9.	CAD/CAM Software IDEAS Artisan Series (latest version) – software
10.	Operating System DOS - Non DOS
11.	MS or Open Office
12.	C / C++
13.	Photo shop
14.	Bread Board
15.	Integrated Circuits (IC's)
16.	CROs
17.	Adobe Animate
18.	Python
19.	PHP
20.	Word Press
21.	MOODLE
22.	Android Virtual Studio
23.	Joomla
24.	Digital Signature
25.	WAMP / XAMPP
26.	MySQL
27.	Tensorflow Libraries
28.	CNN Libraries
29.	APIs for NLP models
30.	Hadoop -Framework
31.	MapReduce
32.	PROLOG
33.	PySpark


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