COMPETENCY BASED CURRICULUM

DIPLOMA IN
AGRICULTURE ENGINEERING

(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.

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

TABLE OF CONTENTS

1 SALIENT FEATURES

1.	Name	:	Diploma in Agriculture Engineering
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	**:**	**Multi Point Entry and Exit**
8.	NSQF Level	:	**5**
9.	Theory Practical Ratio	:	**38 : 64**
10.	Project Work	:	**Project Oriented Professional Training**
11.	In-house/Industrial Training	:	**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.

Fig.1: NSQF Domains

NSQF LEVEL - 3 COMPLIANCE

The NSQF level - 3 descriptor is as follows:

Process	• Person may carry out a job which may require limited range of activities routine and predictable.
Professional Knowledge	• Basic facts, process and principle applied in trade of employment.
Professional Skill	• Recall and demonstrate practical skill, routine and repetitive in narrow range of application.
Core Skill	• Communication written and oral, with minimum required clarity, skill of basic arithmetic and algebraic principles, personal banking, basic understanding of social and natural environment.
Responsibility	• Under close supervision. Some responsibility for own work within defined limit.

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.

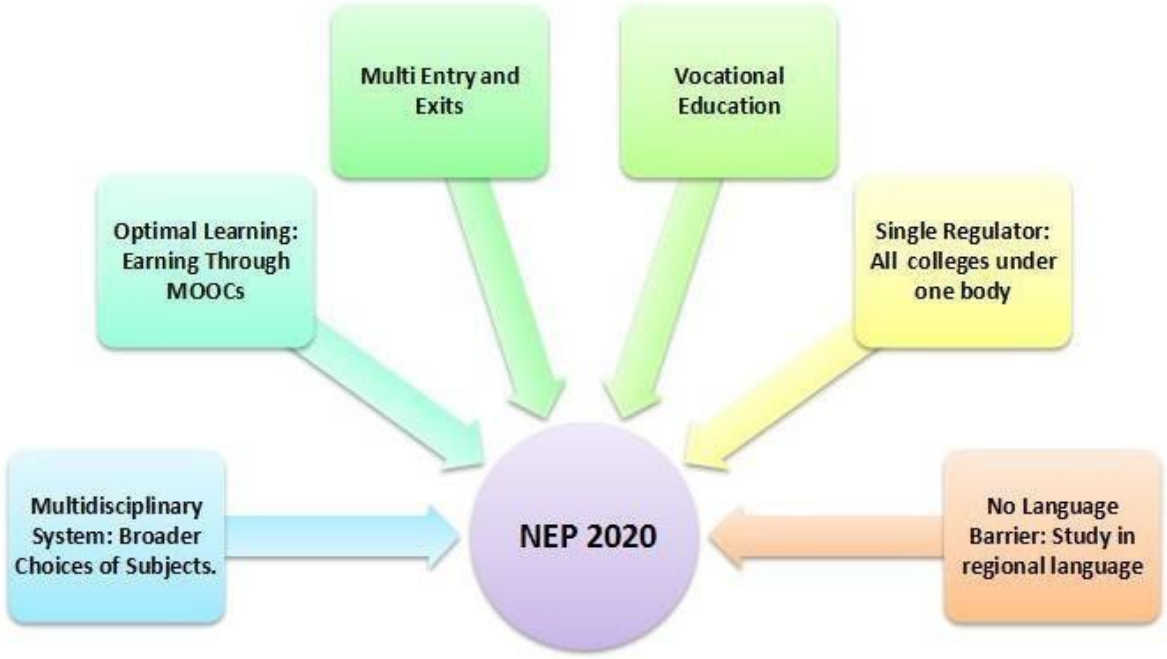

Fig 5: NEP 2020

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 as research 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 DIPLOMA 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 studentwill be able to:

PO1: Perform tasks in limited range of activities, familiar situation with clear choice of procedures.

PO2: Acquire knowledge of principles and processes in the field of Agriculture Engineering.

PO3: Develop skills to accomplish quality tasks and solve problems using methods, tools, materials and information**.**

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

PO5: Take the responsibility of own works and supervise others work.

PO6: Select multidisciplinary subjects of own interest from broader choices.

PO7: Perform Self Learning through Massive Open Online Courses (MOOCs).

5 DERIVING CURRICULUM SUBJECT AREAS FROM DIPLOMA PROGRAMME OUTCOMES

The following curriculum subject areas have been derived from Programme outcomes:

Sr. No.	Programme Outcomes	Curriculum Subject Areas
1.	Perform tasks in limited range of activities, familiar situation with clear choice of procedures.	• General Workshop Practice • Workshop Practice I • Engineering Graphics • Applied Mathematics • Applied Physics - I • Applied Chemistry
2.	Acquire knowledge of principles and processes in Agriculture Engineering related field.	• Workshop Technology-I • Applied Mathematics • Applied Physics – I • Basics of Agriculture Engineering • Crop Production • Farm Irrigation Engineering • IC Engine • Farm Machinery and Implements – I • Farm Machinery and Implements – II • Post-Harvest Technology • Agro Process Engineering • Manufacturing Technology • Soil and Water Conservation • Computer Aided Design in Agriculture Engineering • Farm Tractor • Precision Agriculture • Renewable Energy Sources in Agriculture Engineering

3.	Develop skills to accomplish quality tasks and solve problems using methods, tools, materials and information.	• General Workshop Practice • Workshop Practice I • Engineering Graphics • Mechanical Engg Drawing I • Industrial /In-House Training. • Farm Machinery and Implements – I • Farm Machinery and Implements - II • Manufacturing Technology • Computer Aided Design in AgricultureEngineering
4.	Demonstrate skill of communication, basic mathematics, collecting and organizing information along with knowledge of social, political and natural environment.	• English and Communication Skills – I • English and Communication Skills - II • Applied Mathematics • Fundamentals of IT • Environmental Studies & Disaster Management • Entrepreneurship Dev. & Management
5.	Take the responsibility of own works and supervise others work.	• General Workshop Practice • Workshop Practice I • Industrial / In-House Training • Industrial Training • Entrepreneurship Dev. & Management
6.	Select multidisciplinary subjects of own interest from broader choices.	• Multidisciplinary Elective (MOOCs/Ofline) • Project Oriented Professional Training
7.	Perform Self Learning through Massive Open Online Courses (MOOCs).	• Multidisciplinary Elective • Open Elective (MOOCs^{+}/Offline)

FIRST YEAR
NSQF LEVEL - 3

6. DIPLOMA PROGRAMME STUDY AND EVALUATION SCHEME
FIRST YEAR

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	Tot	Th	Pr	Tot	
1.1	*English and Communication Skills –I	2	2	2+1=3	40	40	80	60	60	120	200
1.2	**Applied Mathematics	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	*Applied Chemistry	3	2	3+1=4	40	40	80	60	60	120	200
1.5	*Engineering Graphics	-	6	0+3=3	-	40	40	60	-	60	100
1.6	*General Workshop Practice	-	6	0+3 = 3	-	40	40	-	60	60	100
#Student Centred Activities (SCA)		-	6	-	-	-	-	-	-	-	-
Total		**11**	**24**	**20**	**160**	**200**	**360**	**300**	**240**	**540**	**900**

* Common with other diploma programmes

** Same as Applied Mathematics I and Common with other diploma programmes.

Student Centred Activities will comprise of co-curricular activities like extension lectures on Constitution of India, etc, Games, Yoga, Human Values & Ethics, Knowledge of Indian System, Hobby clubs e.g. Photography etc., Seminars, Declamation Contests, Educational field visits, NCC, 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 Marks of Internal & External
					INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT			
		L	P		Th	Pr	Tot	Th	Pr	Tot	
2.1	*Fundamentals of IT	2	4	2+2=4	40	40	80	60	60	120	200
2.2	**Mechanical Engineering Drawing- I	-	6	0+3=3	-	40	40	60	-	60	100
2.3	Basics of Agriculture Engineering	3	2	3+1=4	40	40	80	60	60	120	200
2.4	*Environmental Studies & Disaster Management	2	-	2+0=2	40	-	40	60	-	60	100
2.5	Crop Production	4	2	4+1=5	40	40	80	60	60	120	200
2.6	**Workshop Practice- I	-	6	0+3=3	-	40	40	-	60	60	100
#Student Centred Activities (SCA)		-	4	-	-	-	-	-	-	-	-
Total		**11**	**24**	**21**	**160**	**200**	**360**	**300**	**240**	**540**	**900**

* Common with other diploma programmes

** Common with diploma in Mechanical Engineering

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

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

7. HORIZONTAL AND VERTICAL ORGANISATION OFSUBJECTS

Sr. No.	Subjects	Hours Per Week	
		First Semester	Second Semester
1.	English and Communication Skills - I	4	-
2.	Applied Physics - I	4	-
3.	Applied Chemistry	5	-
4.	Engineering Graphics	6	-
5.	Applied Mathematics	4	-
6.	General Workshop Practice	6	-
7.	Fundamentals of IT	-	6
8.	Mechanical Engg. Drawing I	-	6
9.	Basics of Agriculture Engineering	-	5
10.	Environmental Studies & Disaster Management	-	2
11.	Crop Production	-	6
12.	Workshop Practice I	-	6
13.	Student Centered Activities	6	4
	Total	**35**	**35**

8. COMPETENCY PROFILE AND EMPLOYMENT OPPORTUNITIES

In government and private sectors related to Agriculture Engineering, "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. They should know the basic facts, processes and principles applied in limited area of Agriculture Engineering.

The NSQF Level – 3 pass out students are expected to recall and demonstrate practical routine and repetitive skills, in narrow range of Agriculture Engineering applications. They are expected to understand what constitutes quality in their job role. They are also expected to carry out the jobs given to them safely and securely. They have wide scope to work as semi-skilled employee on wage basis mainly in following agriculture related organizations:

- Agriculture Machinery Manufacturing
- Processing Agro Industry
- Agriculture Implements Manufacturing

They have good avenues in establishing small startups in the area of Marketing and Sales, Manufacturing Units and Repair and Maintenance units etc.

9. PROGRAMME OUTCOMES

The program 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: Carry out a task which may require limited range of predictable activities.

PO2: Acquire knowledge of basic facts, process and principles related to Agriculture Engineering for employment.

PO3: Demonstrate practical skill in narrow range of Agriculture Engineering applications.

PO4: Communicate in written and oral, with minimum required clarity along with skill of basic arithmetic and algebraic principles, personal banking and basic understanding of social and natural environment.

PO5: Perform task under close supervision with some responsibility for own work withindefined limit.

10. ASSESSMENT OF PROGRAMME AND COURSE OUTCOMES

Programme Outcomes to be Assessed	Assessment Criteria for the Course Outcomes
PO1: Carry out a task which may require limited range of predictable activities.	• Identify tools, equipment and materials used in preparing jobs. • Take measurements with the help of basic measuring tools/equipment. • Select materials, tools, and sequence of operations to make a job as per given specifications/drawing. • Prepare simple jobs independently and inspect the same. • Use safety equipment and Personal Protection Equipment (PPE). • Maintain good housekeeping practices. • Identify physical quantities, select their units 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. • Differentiate between types of waves and their motion. • Illustrate laws of reflection and refraction of light. • Demonstrate competency in phenomena of electrostatics and electricity. • Classify the elements into metals, non-metals and metalloids. • Explain the extraction of metals from ores, their mechanical properties and modification of properties by alloy formation.

	• Classify fuels and lubricants and apply them in different engineering applications. • Identify the polymeric materials, assess their properties and design suitable polymeric materials for current and future applications. • Apply effective methods for corrosion prevention. • Draw free body diagrams by analyzing different types of forces acting on a body. • Determine the resultant of coplanar concurrent forces. • Solve problems by using principle of moment. • Calculate the least force required to maintain equilibrium on an inclined plane. • Determine the centroid/centre of gravity of plain and composite laminar and solid bodies. • Determine velocity ratio, mechanical advantage and efficiency of simple machines.
PO2: Acquire knowledge of basic facts, process and principles related to Agriculture Engineering for employment.	• Identify physical quantities, select their units 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. • Demonstrate competency in phenomena of electrostatics and electricity. • Characterize properties of material to prepare new materials for various

	engineering applications. • Draw free body diagrams by analyzing different types of forces acting on a body. • Determine the resultant of coplanar concurrent forces. • Solve problems by using principle of moment. • Calculate the least force required to maintain equilibrium on an inclined plane. • Determine the centroid/centre of gravity of plain and composite laminar and solid bodies. • Determine velocity ratio, mechanical advantage and efficiency of simple machines. • Classify various types of hand tools. • Explain working principle of vernier caliper and micrometer for measurement. • Explain the parts of lathe and their functions. • Select material and tool geometry for cutting tools on lathe. • Explain geometry of single point tool, various types of lathe tools and tool materials. • Explain the working of drilling and boring process. • Explain the nomenclature of a drill and boring tools. • Select most appropriate process, electrodes, various process parameters for a job. • Explain principle of gas welding and arc welding process. • Select a cutting fluid for an operation.

PO3: Demonstrate Practical skill in narrow range of Agriculture Engineering applications.	• Elaborate scientific work, energy and power, forms of friction and solve problems related to them. • Comprehend properties of matter and effect of temperature on various matter and phenomenon. • Characterize properties of material to prepare new materials for various technical applications. • Demonstrate the use of physical principles andanalysis in various technical fields. • Demonstrate a strong foundation on Modern Physics to use at various technical applications • Identify tools, equipment and materials used in preparing jobs. • Take measurements with the help of basic measuring tools/equipment. • Select materials, tools, and sequence of operations to make a job as per given specifications/drawing. • Prepare simple jobs independently and inspect the same. • Use safety equipment and Personal Protection Equipment (PPE). • Maintain good housekeeping practices. • Draw Orthographic views of different objects viewed from different angles. • Draw and interpret sectional views of an object which are otherwise not visible in normal view. • Draw Isometric views of different solids and develop their surfaces.

	• Identify conventions for different engineering materials, symbols, sections of regular objects and general fittings used in Civil and Electrical household appliances /fittings. • Draw orthographic views of different objects by using basic commands of AutoCAD.
PO4: Demonstrate skill of communication, basic mathematics, collecting and organizing information along with knowledge of social, political 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. • 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. • 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 • Understand 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. • 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. • Calculate the approximate area under a curve by applying integration and numerical methods. • Discuss the purposes of measures of central tendency and calculate the measures of central tendency (mode, median, mean) for a set of data. • Learn about basic fundamentals about MATLAB/ SciLab and mathematical calculation with MATLAB/ SciLab software.

PO5: Perform task under close supervision with some responsibility for own work within defined limit.	• Take measurements with the help of basic measuring tools/equipment. • Select materials, tools, and sequence of operations to make a job as per given specifications/drawing. • Prepare simple jobs independently and inspect the same. • Use safety equipment and Personal Protection Equipment (PPE). • Maintain good housekeeping practices.

11. SUBJECTS & DETAILED CONTENTS

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 subject, 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

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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 subject, 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

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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 subject, 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

PRACTICAL 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 APPLIED CHEMISTRY

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3	2

RATIONALE

The regular use of a variety of chemistry based materials and processes in diverse technical and engineering fields have repeatedly proven the importance of Applied Chemistry and its role in current and future technological advancements. Ever increasing use of chemical materials in the emerging engineering applications demands engineers and technocrats to acquire an in-depth knowledge of Applied Chemistry to be able to choose the best suited materials to meet their needs while maintaining the environment sustainability. An understanding of the principles of Applied Chemistry will develop scientific attitude in the budding engineers to understand the physical and chemical properties of the available materials for engineering applications as well as an ability to design new and effective materials.

COURSE OUTCOMES

After studying this subject, students will be able to:

CO1: Classify the elements into metals, non-metals and metalloids.

CO2: Explain the extraction of metals from ores, their mechanical properties and modification of properties by alloy formation.

CO3: Classify fuels and lubricants and apply them in different engineering applications.

CO4: Identify the polymeric materials, assess their properties and design suitable polymeric materials for current and future applications.

CO5: Apply effective methods for corrosion prevention,

DETAILED CONTENTS

UNIT 1

Atomic Structure, Periodic Table and Chemical Bonding.

1.1 Bohr's model of atom (qualitative treatment only), dual character of matter: derivation of de- Broglie's equation, Heisenberg's Principle of Uncertainty, modern concept of atomic structure: definition of orbitals, shapes of s, p and d-orbitals, quantum numbers and their significance. Electronic configuration: Aufbau and Pauli's exclusion principles and Hund's rule, electronic configuration of elements up to atomic number 30.

1.2 Modern Periodic law and Periodic table, classification of elements into s, p, d and f-blocks, metals, non-metals and metalloids (periodicity in properties excluded).

1.3 Chemical bonding: cause of bonding, ionic bond, covalent bond, and metallic bond (electron sea or gas model), Physical properties of ionic, covalent and metallic substances.

UNIT II

Metals and Alloys

2.1 Metals: mechanical properties of metals such as conductivity, elasticity, strength and stiffness, luster, hardness, toughness, ductility, malleability, brittleness, and impact resistance and their uses.

2.2 Definition of a mineral, ore, gangue, flux and slag. Metallurgy of iron from haematite using a blast furnace. Commercial varieties of iron.

2.3 Alloys: definition, necessity of making alloys, composition, properties and uses of duralumin and steel. Heat treatment of steel- normalizing, annealing, quenching, tempering.

UNIT III

Water, Solutions, Acids and Bases

3.1 Solutions: definition, expression of the concentration of a solution in percentage (w/w, w/v and v/v), normality, molarity and molality and ppm. Simple problems on solution preparation.

3.2 Arrhenius concept of acids and bases, strong and weak acids and bases, pH value of a solution and its significance, pH scale. Simple numerical problems on pH of acids and bases.

3.3 Hard and soft water, causes of hardness of water, types of hardness – temporary and permanent hardness, expression of hardness of water, ppm unit of hardness; disadvantages of hard water; removal of hardness: removal of temporary hardness by boiling and Clark's method; removal of permanent hardness of water by Ion-Exchange method; boiler problems caused by hard water: scale and sludge formation, priming and foaming, caustic embrittlement; water sterilization by chlorine, UV radiation and RO.

UNIT IV

Fuels and Lubricants

4.1 Fuels: definition and classification of higher and lower calorific values, units of calorific value, characteristics of an ideal fuel. Petroleum: composition and refining of petroleum; gaseous fuels: composition, properties and uses of CNG, PNG, LNG, LPG; relative advantages of liquid and gaseous fuels over solid fuels. Scope of hydrogen as future fuel.

4.2 Lubricants- Functions and qualities of a good lubricant, classification of lubricants with examples; lubrication mechanism (brief idea only); physical properties (brief idea only) of a lubricant: oiliness, viscosity, viscosity index, flash and fire point, ignition temperature, pour point.

UNIT V

Polymers and Electrochemistry

5.1 Polymers and Plastics: definition of polymer, classification, addition and condensation polymerization; preparation properties and uses of polythene, PVC, Nylon-66, Bakelite; definition of plastic, thermoplastics and thermosetting polymers; natural rubber and neoprene, other synthetic rubbers (names only).

5.2 Corrosion: definition, dry and wet corrosion, factors affecting rate of corrosion, methods of prevention of corrosion—hot dipping, metal cladding, cementation, quenching, cathodic protection methods

5.3 Introduction and application of nanotechnology: nano-materials and their classification, applications of nanotechnology in various engineering applications (brief).

PRACTICAL EXERCISES

1. To prepare standard solution of oxalic acid.
2. To dilute the given KMnO4 solution
3. To find out the strength in grams per litre of an unknown solution of sodium hydroxide using a standard (N/10) oxalic acid solution.
4. To find out the total alkalinity in parts per million (ppm) of a water sample with the help of a standard sulphuric acid solution.
5. To determine the total hardness of given water sample by EDTA method.
6. To determine the amount of total dissolved solids(TDS) in ppm in a given sample of water gravimetrically.
7. To determine the pH of different solutions using a digital pH meter.
8. To determine the calorific value of a solid/liquid fuel using a Bomb calorimeter.
9. To determine the viscosity of a lubricating oil using a Redwood viscometer.
10. To prepare a sample of Phenol-formaldehyde resin (Bakelite)/Nylon-66 in the lab.

RECOMMENDED BOOKS

1. "Textbook of Chemistry for class XI and XII (part I & II) NCERT", Delhi, 2017-18.
2. C.N. R. Rao, "Understanding Chemistry", Universities Press (India) Pvt. Ltd, 2011.
3. Jain & Jain, "Engineering Chemistry", Dhanpat Rai and Sons; New Delhi, 2015.
4. Dr. G. H. Hugar & Prof A. N. Pathak, "Applied Chemistry Laboratory Practices, Vol. I and Vol. II", NITTTR, Chandigarh, Publications, 2013-14.
5. Rajesh Agnihotri, "Chemistry for Engineers", Wiley India Pvt. Ltd, 2014.
6. "Applied Chemistry" by Usha Raju.

SUGGESTED WEBSITES

1. www.chemguide.co.uk/atommenu.html (Atomic structure and chemical bonding)
2. www.visionlearning.com (Atomic structure and chemical bonding)
3. www.cheml.com (Atomic structure and chemical bonding)
4. https://www.wastewaterelearning.com/elearning/ (Water treatment)
5. www.capital-refractories.com (Metals, Alloys, Cement, and Refractory Materials)
6. www.em-ea.org/guide%20books/book-2/2.1%20fuels%20and%20combustion.pdf (Fuel and Combustion)

INSTRUCTIONAL STRATEGY

Teachers may take help of various models and charts while imparting instructions to make the concept clear. More emphasis should be laid on discussing and explaining practical applications of various chemical process and reactions. In addition, students should be encouraged or motivated to study those processes in more details, which may find practical application in their future professional career. This subject contains five units of equal weightage.

1.5 ENGINEERING GRAPHICS

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RATIONALE

Drawing is the language of engineers and technicians. Reading and interpreting engineering drawings is their day to day responsibility. The subject is aimed at developing basic graphic skills in the students so as to enable them to use these skills in preparation of engineering drawings, their reading and interpretation. The emphasis, while imparting instructions, should be to develop conceptual skills in the students following BIS SP 46 – 1988.

COURSE OUTCOMES

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

CO1: Draw Orthographic views of different objects viewed from different angles.

CO2: Draw and interpret sectional views of an object which are otherwise not visible in normal view.

CO3: Draw Isometric views of different solids and develop their surfaces.

CO4: Identify conventions for different engineering materials, symbols, sections of regular objects and general fittings used in Civil and Electrical household appliances /fittings.

CO5: Draw orthographic views of different objects by using basic commands of AutoCAD.

DETAILED CONTENTS

UNIT I

1. Introduction to Engineering Drawing and Graphics

1.1 Introduction to use and care of drawing instruments, drawing materials, layout and sizes of drawing sheets and drawing boards.

1.2 Symbols and conventions-

a) Conventions of Engineering Materials, Sectional Breaks and Conventional lines.

b) Civil Engineering Sanitary fitting symbols

c) Electrical fitting symbols for domestic interior installations.

1.3 Geometrical construction-geometrical figures such as triangles, rectangles, circles, ellipses and curves, hexagons, pentagons bisecting a line and arc , division of line and circle with the help of drawing instruments.

2. Technical Lettering of Alphabet and Numerals

Definition and classification of lettering, Free hand (of height of 5,8,12 mm) and instrumental lettering (of height 20 to 35 mm) : upper case and lower case, single and double stroke, vertical and inclined (Gothic lettering) at 75 degree to horizontal and with suitable height to width ratio 7:4.

3. Dimensioning

3.1 Necessity of dimensioning, method and principles of dimensioning (mainly theoretical instructions).

3.2 Dimensioning of overall sizes, circles, threaded holes, chamfered surfaces, angles, tapered surfaces, holes, equally spaced on P.C.D., countersunk holes, counter bored holes, cylindrical parts, narrow spaces and gaps, radii, curves and arches.

4. Scales

4.1 Scales –Needs and importance (theoretical instructions), Type of scales, Definition of Representative Fraction (R.F.) and Length of Scale.

4.2 To draw/construct plain and diagonal scales.

UNIT II

1. Orthographic Projections

1.1 Theory of orthographic projections (Elaborate theoretical instructions).

1.2 Three views of orthographic projections of different objects of given pictorial view of a block in 1st and 3rd angle.

1.3 Projection of Points in different quadrant

1.4 Projection of Straight Line (1^{st} angle)

i. Line parallel to both the planes.

ii. Line perpendicular to any one of the reference plane and parallel to others

iii. Line inclined to any one of the references and parallel to another plane.

1.5 Projection of Plane – Different lamina like square rectangular, triangular, circle and Hexagonal pentagon. Trace of planes (HT and VT).

1.6 Identification of surfaces.

2. Sectioning

2.1 Importance and salient features

2.2 Drawing of full section, half section, partial or broken out sections, Offset sections, revolved sections and removed sections (theoretical only).

2.3 Orthographic sectional views of different objects.

UNIT III

1. Introduction of projection of right solids such as prism & pyramid (square, Pentagon, Hexagonal) cube, cone & cylinder (Axes perpendicular to H.P and parallel to V.P.)
2. Introduction of sections of right solids - Section planes, Sections of Hexagonal prism, pentagon pyramid, cylinder and cone (Section plane parallel to anyone reference planes and perpendicular to V.P. and inclined to H.P.)
3. Development of Surfaces – Development of lateral surfaces of right solids like cone, cylinder, pentagonal prism, pyramid and hexagonal pyramid (Simple problems)

UNIT IV

Isometric Views

1. Fundamentals of isometric projections and isometric scale.
2. Isometric views of different laminas like circle, pentagon and hexagon.
3. Isometric views of different regular solids like cylinder, cone, cube, cuboid, pyramid and prism.
4. Isometric views from given different orthographic projections(front, side and top view)

UNIT V

Introduction to AutoCAD

Basic introduction and operational instructions of various commands in AutoCAD. At least two sheets of different objects on AutoCAD (given pictorial/isometric view of a block). AutoCAD skill of student is evaluated in internal assessment only not in external exam.

RECOMMENDED BOOKS

1. Surjit Singh, “A Text Book of Engineering Drawing”, Dhanpat Rai & Co., Delhi.
2. PS Gill, “Engineering Drawing”, SK Kataria & Sons, New Delhi.
3. ND Bhatt, “Elementary Engineering Drawing in First Angle Projection”, Charotar Publishing House Pvt. Ltd., Anands.
4. T. Jeyapoovan, “Engineering Drawing and Graphics using AutoCAD”,Vikas Publishing House Pvt, Ltd Noida.
5. S.R.Singhal and O.P.Saxena, “A Text Book of Engineering Drawing”, Asian Publisher, Delhi.
6. RB Gupta, “Engineering Drawing”, Satya Prakashan, New Delhi.

INSTRUCTIONAL STRATEGY

Teacher should show model of realia of the component/part whose drawing is to be made. Emphasis should be given on cleanliness, dimensioning and layout of sheet. Focus should be on proper selection of drawing instruments and their proper use. First angle projection is to be

followed. Minimum of 20 sheets to be prepared and at least 2 sheets on AutoCAD**.** Instructions relevant to various drawings may be given along with appropriate demonstrations, before assigning drawing practice to students. This subject contains five units of equal weight age.

1.6 GENERAL WORKSHOP PRACTICE

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RATIONALE

In order to have a balanced overall development of diploma engineers, it is necessary to integrate theory with practice. General Workshop Practice is included in the curriculum in order to provide hands-on experience about use of different tools and basic manufacturing practices. This subject aims at developing general manual and machining skills in the students. In addition, the development of dignity of labour, safety at work place, team working and development of right attitude are the other objectives.

COURSE OUTCOMES

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

CO1: Identify tools, equipment and materials used in preparing jobs.
CO2: Take measurements with the help of basic measuring tools/equipment.
CO3: Select materials, tools, and sequence of operations to make a job as per given specifications/drawing.
CO4: Prepare simple jobs independently and inspect the same.
CO5: Use safety equipment and Personal Protection Equipment (PPE).
CO6: Maintain good housekeeping practices.

DETAILED CONTENTS CUM PRACTICAL EXERCISES

Note: The students are supposed to come in proper workshop dress prescribed by the institute. Wearing shoes in the workshop(s) is compulsory. Importance of safety and cleanliness, safety measures and upkeep of tools, equipment and environment in each of the following shops should be explained and practiced. The students should prepare sketches of various tools/jobs in their practical Notebook.

The following shops are included in the syllabus:

1. Welding Shop I
2. Fitting and Plumbing Shop I
3. Sheet Metal Shop
4. Carpentry Shop I
5. Painting Shop
6. Electric and Electronics Shop I

1. WELDING SHOP – I

1.1 Safety Precautions of concerned shop and use of personal protective equipment (PPE), demonstration of tools, equipment, sample jobs, Best practices in the concerned shop.

1.2 Introduction and importance of welding process as compared to other material joining processes. Specifications and type of ARC welding machines, parts identification, classification, selection and coding of electrodes, welding parameters, welding joints and welding positions. Common weldable materials, safety precautions in welding shop, use of Personal Protective Equipment, Use of welding screens, Hazards and remedies during welding, Elementary symbolic representations, demo of tools, equipment, sample jobs prepared, set up of Gas welding apparatus, and welding defects.

1.3 Jobs to be prepared

- Job I Practice of striking arc and depositing uniform and straight beads onflat at different current levels. (Minimum 4 beads on M.S. flat at four setting of current level using shielded metal arc welding and differentiating their characteristics).
- Job II Edge Preparation and welding lap joint using shielded metal arcwelding (SMAW) process.
- Job III Edge Preparation and welding butt joint using shielded metal arcwelding process.
- Job IV Edge Preparation and welding T Joint using shielded metal arcwelding (100mm x 6 mm M.S. Flat).
- Job V To make a simple job using oxy acetylene gas welding.

2. FITTING AND PLUMBING SHOP – I

2.1 Safety Precautions of concerned shop and use of personal protective equipment (PPE), demonstration of tools, equipment, sample jobs, Best practices in the concerned shop.

2.2 Introduction and Function of holding/ clamping devices, hand tools and cutting tools,

2.3 Practical applications of fitting and plumbing

2.4 Introduction, function and types of marking and measuring tools and instruments (surface plate, try square, caliper, steel rule, scriber and Vernier caliper)

2.5 Identification of materials. (Iron, Copper, Stainless Steel, Aluminum etc.) and identification of various steel sections (flat, angle, channel, bar etc.).

2.6 Introduction to various types of pipes (eg water, steam, gas etc) and functions of various pipe fitting items (GI pipe fittings, CPVC pipe fittings), Methods of pipe joints

2.7 Introduction to various types of threads (internal and external)

2.8 Description and demonstration of various types of drills, taps and dies.

2.9 Jobs to be prepared:

- Job I To fit hacksaw blade in its frame and perform hacksawing operation byusing marking media and marking tool and straight sawing practice.
- Job II To perform filing on MS workpiece (75 * 50 * 6 mm) for giving it aperfect rectangular shape and drilling, tapping operation.

Job III To perform step filing operation at right angle on MS workpiece.

Job IV Making external threads on a pipe by using die and to make a PVC/GI pipe connection using nipple and socket.

Job V Fitting of all components of wash basin and ball valve in a tank.

3. SHEET METAL SHOP

3.1. Safety Precautions of concerned shop and use of personal protective equipment (PPE), demonstration of tools, equipment, sample jobs, best practices in the concerned shop.

3.2 Demonstration of various power tools, apparatus, equipment, hand tools used in sheet metal shop.

3.3 Jobs to be prepared

Job I Prepare a seam joint by using hand tools on GI sheet.

Job II To prepare riveted lap joint (single/double) on GI sheet.

Job III To fabricate a funnel of GI sheet using operations of shearing, flatteningand bending.

Job IV To fabricate a conduit joint using various sheet metal operations.

Job V To fabricate a utility job (eg soap case/file tray/canister box) of thin GIsheet.

4. CARPENTRY SHOP - I

4.1 Safety Precautions of concerned shop and use of personal protective equipment (PPE), demonstration of tools, equipment, sample jobs, Best practices in the concerned shop.

4.2 Introduction and industrial applications of carpentry jobs.

4.2.1 Name and use of raw materials used in carpentry shop : wood & alternative materials(board, plywood)

4.2.2 Introduction to wood, timber and their identification, shapes and specifications, their properties, applications & defects. Study of the joints in roofs, doors, windows and furniture, seasoning of wood

4.2.3 Names, uses, and types of hand tools such as Saws, C-Clamp, Chisels, Mallets, Carpenter's vices, Marking gauges, Try-squares, Rulers and other commonly used tools and materials used in carpentry shop by segregating as cutting tools, supporting tools, holding tools, measuring tools etc.

4.2.4 Specification of iron jack plane used in carpentry shop.

4.3 Practice

4.3.1 Practices for Basic Carpentry Work

4.3.2 Sawing practice using different types of saws

4.3.3 Assembling jack plane — planning practice including sharpening and bladeadjustment of jack plane cutter

4.3.4 Chiselling practice using different types of chisels including sharpening ofchisel

4.3.5 Making of different types of wooden pin and fixing methods. Markingmeasuring and inspection of jobs.

4.3.6 Housekeeping practices and instructions.

4.4 Jobs to be Prepared

Job 1 Prepare a rectangular wooden block involving operations likeMarking, sawing, planning to size, chiseling.

Job II Prepare a Half Lap Joint (cross, L or T – any one).

Job III Prepare a Mortise and Tenon joint (T-Joint).

Job IV Prepare a Dove tail Joint (Half lap dovetail joint.

Job V Prepare a Bridle Joint.

5. PAINTING SHOP

5.1 Safety Precautions of concerned shop and use of personal protective equipment (PPE), demonstration of tools, equipment, sample jobs, Best practices in the concerned shop.

5.2 Introduction to paints, varnishes, primers and their types, General properties of paints, Constituents of paints, polishes, their advantages and applications.

5.3 Introduction of powder coating and spray painting with their uses. Different types of tools and equipment used in polishing and painting.

5.4 Preparation of different colours of the paints by using prime colours, Practical demonstration of powder coating and spray painting on a utility object

5.5 Jobs to be Prepared

Job I Prepare wooden surface for painting such as cleaning, sanding, applying putty, filling procedure and application of primer coat andbrush paint the same.

Job II Painting on wooden and metallic surfaces by spray gun.

Job III Practice of lettering: name plates / sign board.

Job IV Practice of dip painting/powder coating.

Job V Prepare wooden surface for polishing, apply French polish on woodensurface.

6. ELECTRICAL AND ELECTRONICS SHOP - I

6.1 Safety Precautions of concerned shop and use of personal protective equipment (PPE), demonstration of tools, equipment, sample jobs, best practices in the concerned shop.

6.2 Demonstration and identification of common electrical materials with standard ratings and specifications such as wires, cables, switches, MCB & ELCB, fuses, cleats, clamps and allied items, tools and accessories.

6.3 Identification of phase, Neutral and Earth wires for connection to domestic electrical appliances and their connections to three pin plugs. Difference between series and parallel wiring.

6.4 Jobs to be performed

Job I Carrying out house wiring circuits using fuse, switches, sockets,ceiling rose etc. in batten or P.V.C. casing-caping. Demo of conduit wiring through junctions.

Job II To prepare a three level Godown wiring circuit with PVC conduitwiring system.

Job III Installation of Solar Panel, inverter and batteries.

6.5 Identification and familiarization with the following tools used in electronic shop such as Tweezers, Screw drivers (different sizes), Insulated Pliers, Cutter, Sniper, Philips Screw Driver (Star Screw Driver), L- Keys, Soldering Iron, soldering wire, flux and their demonstration and uses. Identification and familiarization with multimeter (analog and digital). Various types of protective devices such as wire fuse, cartridge fuse etc. Identification and familiarization with ear phone speaker connector, telephone jacks and similar male and female connectors (audio, video).

6.6 Jobs to be performed

Job IV Practice in the use of tools and instruments used in electronicshop. For this a small experimental set up may be done.

Job V Cut, strip, join an insulated wire with the help of soldering iron(repeat with different types of wires).

RECOMMENDED BOOKS

1. SK Hajra Choudhary and AK Choudhary, "Workshop Technology I, II, III", Media Promoters and Publishers Pvt. Ltd., Mumbai, Fifteenth Edition, 2016.
2. RK Jain, "Workshop Technology Vol I& II'', Khanna Publishers, New Delhi, First Edition,2021.
3. Manchanda, "Workshop Technology Vol. I, II, III", India Publishing House, Jalandhar.
4. S.S. Ubhi, "Workshop Training Manual Vol. I, II'', Katson Publishers, Ludhiana.
5. K Venkata Reddy, "Manual on Workshop Practice", MacMillan India Ltd., New Delhi,Sixth Edition, 2020.
6. "General Workshop Manual (Diploma Jobs)", Khanna Publishers, First Edition, 2021.
7. T Jeyapoovan, "Basic Workshop Practice Manual", Vikas Publishing House (P) Ltd., NewDelhi.
8. B. S. Raghuvanshi, "Workshop Technology, Vol. I", Dhanpat Rai and Sons, Delhi, EleventhEdition, 2017.
9. Kannaiah K L, Narayana, "Workshop Manual", Scitech Publications, Chennai, Second Edition 1998.
10. H S Bawa, "Workshop Practice", Tata McGraw Hill Publication, First Edition, 2004

INSTRUCTIONAL STRATEGY

This is hands-on practice based workshop for development of required skills in the students.

SECOND SEMESTER

SECOND SEMESTER

2.1 FUNDAMENTALS OF IT

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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 subject 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, GDrive, 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.

PRACTICAL 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.

2.2 MECHANICAL ENGINEERING DRAWING-I

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RATIONALE

Drawing is the language of engineers and technicians. Reading and interpreting engineering drawing is their day-to-day responsibility. The subject is aimed at developing basic graphic skills in the students so as to enable them to use these skills in preparation of engineering drawings, their reading and interpretation. The emphasis, while imparting instructions, should be to develop conceptual skills in the students following BIS SP 46 – 1988.

Note:

1) First angle projection is to be followed.
2) Minimum 15 sheets to be prepared.
3) BIS Code SP 46-1988 should be followed.
4) Instructions relevant to various drawings may be given along with appropriate demonstration before assigning drawing practice to the students.
5) 20 percent of drawing sheets to be prepared on the third angle projection.
6) Use CAD software.

COURSE OUTCOMES

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

CO1: Draw the assembly from part details of objects.
CO2: Identify and draw different types of screw threads.
CO3: Draw different types of nuts, bolts and washers.
CO4: Draw various locking devices.
CO5: Draw different section of various types of keys and cotter joints.
CO6: Draw various riveted joints.
CO7: Draw various types of couplings used in power transmission.
CO8: Prepare drawing using AutoCAD.

PRACTICAL EXERCISES

1. Detail and Assembly Drawing (02 sheets)

Principle and utility of detail and assembly drawings, Practical exercise on drawing from detail to assembly or vice versa using different wooden joints as example (lap joint – T joint and corner joint, Mortise and tenon joint, Bridle joint, Mitre faced corner joint).

2. Threads (02 sheets)

Nomenclature of threads, types of threads. Single and multiple start threads, right hand and left hand thread. Forms of various external thread sections such as V thread (Metric thread, British associate, American thread, Basic whitworth thread), Square, Acme, Knuckle, and Buttress thread. Simplified conventional representation of V thread.

3. Nuts and Bolts (03 sheets)

Different views of hexagonal and square headed nuts and bolts. Assembled view of nuts and bolts with washers. Foundation bolt- Rag bolt, Hook bolt. Lewis bolt, Eye bolt and curved bolt (Free hand)

4. Locking Devices (01 sheet)

Locking nuts - Castle nut, Sawn nut, and Split pin lock nut. Locking by spring washers,Locking plates.

5. Screws, Studs and Washers (01 sheet)

Drawing of various types of machine and set screws. Drawing of various types' of studs, through bolt, tap bolt and stud bolt.

6. Keys and Cotters (03 sheets)

Various types of keys and their application. Preparation of drawings of various keys and cotters. Various types of joints (a) Gib and Cotter joint (b) Knuckle joint (c) Spigot andSocket joint

7. Rivets and Riveted Joints (02 sheets)

Types of general purpose rivet heads (Snap Head, Pan Head , Flat and counter sunk). Types of riveted joints – lap (single and double riveted), butt (single cover plate and double cover plate), chain and zig-zag riveting (Double riveted). Caulking and fullering operation of riveted joints.

8. Shaft Coupling (02 sheets)

Introduction to coupling, their uses and types, Muff Coupling, Protected type flange coupling. Flexible or non-rigid coupling

9. Computer Aided Drafting (CAD) (04 sheets)

Introduction, Various 2 D commands – Draw, modify and option commands, Prepare at least 4 sheets using CAD software – one drawing each from wooden joint, threads, nut and bolts, coupling.

Note : CAD drawing will be evaluated internally for sessional marks and not by final theory paper.

RECOMMENDED BOOKS

1. Surjit Singh, "A Text Book of Engineering Drawing", Dhanpat Rai Publishing Company,New Delhi.
2. P.S. Gill, "Engineering Drawing", SK Kataria and Sons, New Delhi.
3. N.D. Bhatt, "Mechanical Engineering Drawing", Charotar Publishing House, Anand.
4. T Jeyapoovan, "Engineering Drawing and Graphics Using AutoCAD", Vikas Publishing House Pvt. Limited, Delhi.
5. Sham Tickoo and D. Sarvanan, "AutoCAD : For Engineers & Designers", Wiley India Pvt.Ltd., Delhi.

INSTRUCTIONAL STRATEGY

The teachers should first demonstrate then assist the students to prepare drawing sheets. The student should also be encouraged and motivated to learn CAD software at the earliest and do the given exercises.

2.3 BASICS OF AGRICULTURE ENGINEERING

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RATIONALE

This subject has been introduced with the objective of making the students conversant with the field of Agriculture and Agricultural Engg. and learning the basic concepts of engineering which will be required in the subjects in the subsequent semesters to be studied.

COURSE OUTCOMES

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

CO1: Explain the basic aspects of agriculture engineering.

CO2: Carry out survey and levelling.

C03: Comprehend properties of various types of materials.

C04: Comprehend the principle of refrigeration and air conditioning.

C05: Interpret various terms connected with hydraulics.

DETAILED CONTENTS

UNIT I

1. Agriculture

1.1 Introduction to Agriculture and its types

1.2 Introduction to allied branches of Agriculture

1.3 Introduction to various types of agro based business

1.4 Resource requirement in Agriculture

2. Agricultural Engineering

2.1 Introduction, need, importance and scope of Agriculture Engineering

2.2 Work areas of Agricultural engineers.

2.3 Specialized areas covered under Agriculture Engineering

Farm Power & Machinery - Introduction to various sources of power used at Farm and their adaptability. Introduction to Machinery/ Implements required for different field operations like Tillage, Sowing, Planting, Weeding, Spraying, Dusting, Harvesting, Threshing etc. (their names & functions only) Soil

and Water Engg. - Definition of weather, climate, agricultural meteorology, elements of weather (temperature, atmospheric pressure, wind, solar energy, humidity, atmospheric humidity, relative humidity, precipitation, topography) Hydrology, Hydrologic cycle, precipitation, runoff, evaporation, evapo- transpiration, condensation.

Introduction to Irrigation, sources of irrigation water & irrigation equipment. Concepts of water management, Rain water harvesting, Soil & water conservation, Water logging, Drainage.

Post Harvest Technology & Agro Process Engg - Introduction to Post Harvest Technology and its objectives. Familiarization with various Post Harvest operations and different unit operations in agro processing (Names & functions only).

Renewable Energy - Introduction and importance of Renewable sources of energy.

UNIT II

3. Surveying and Levelling

3.1 Measuring Survey: Ranging a Line, Measuring length with Chain, Measuring length with Tape.

3.2 Levelling: Introduction to Leveling & Uses of Leveling, Leveling Staff (Introduction and types), Dumpy level, its uses and settings, Taking Levels of different stations with the help of Dumpy Level.

3.3 Contouring: Introduction to contours, Use of contours, Contour Intervals and factors affecting contour intervals, Methods of contouring.

UNIT III

4. Engineering Materials and their Properties

4.1 Introduction to Engineering Materials, Importance, Classification of materials Metals and their alloys and nonmetals used in industry.

4.2 Properties of metals and alloys Physical properties- Appearance, Lustre, Colour, Density, Melting point, Dimensions, Porosity, Structure, Mechanical properties- Strength, Tensile Strength, Yield Strength, Impact Strength, Stiffness, Elasticity, Plasticity, Toughness, Ductility, Malleability, Brittleness, Hardness, Fatigue, Creep, Wear resistance.

4.3 Factors affecting Mechanical properties.

4.4 Corrosion, its Causes and Effects, Control and prevention of corrosion.

UNIT IV

5. Heat Energy, Refrigeration & Air Conditioning

5.1 Definition and units of heat energy, Modes of Heat transfer- conduction, convection and radiation, Factors affecting heat energy. Thermal Conductivity.

5.2 Definitions of Refrigeration and Air conditioning, Principles of refrigeration & air conditioning. Major components of Refrigerators, Major components of Air conditioners, Applications of Refrigerators and Air conditioners in agriculture.

UNIT V

6. Hydraulics

6.1 Fluids and Fluid flow: Fluid, Classification of fluids, Hydraulics, Fluid mechanics- Hydrostatics and Hydrodynamics, Practical applications of hydraulics.

6.2 Properties of fluids : Density or Mass density, Specific Weight, Specific volume, Specific gravity, Viscosity, Kinematic viscosity, Surface tension, Cohesion, Adhesion, Compressibility and bulk modulus, Capillarity, Vapour pressure.

6.3 Pressure and its measurement: Concept, units of pressure and its practical utility. Measurement of pressure or measuring devices (Names only)

6.4 Flow of fluids : Kinematics, practical utility, Types of fluid flow- Steady flow, unsteady flow, uniform flow, non-uniform flow, compressible flow, incompressible flow, laminar flow, turbulent flow, rotational flow, ir-rotational flow, Rate of flow or discharge, Hydraulic energy and its types- Potential, pressure or kinetic energy.

PRACTICAL EXERCISES

1. Visit to nearby agro based industries / agro based business units.
2. Identification of basic machine components.
3. Identification of different Engineering materials.
4. Familiarization & acquaintance with the machinery & equipment in Farm Machinery & Implements Lab (Identification & Functions).
5. Familiarization & acquaintance with the machinery & equipment in Soil and Water Engg. Lab (Identification & Functions).
6. Familiarization & acquaintance with the Machinery & Equipment in Agro Process Engg./ Post Harvest Technology Lab (Identification & Functions).
7. Familiarization with different hydraulic equipments of hydraulic lab of the institute.
8. Visit to Krishi Vigyan Kendra.
9. Ranging a line and its measurements.
10. Taking out the levels of different stations with dumpy level.
11. Drawing contours (Indirect methods).

RECOMMENDED BOOKS

1. Jagdishwar Sahay, "Elements of Agriculture Engineering", Standard Publishers Distributors Delhi, Edition 2020.
2. A.M. Michael & T.P.Ojha, "Principles of Agriculture Engg. Vol I & II", Jain Brothers, 2018.
3. A. Chakraverty, "Post Harvest Technology of Cereals, Pulses and Oilseeds", Oxford & IBH Publication Co. Pvt. Ltd., New Delhi, 2019.
4. K.M.Sahay and K.K. Singh, "Unit operations of Agricultural Processing", Vikas Publishing House Pvt. Ltd., New Delhi, 2004.
5. Satinder Rohilla, "Hydraulics and Hydraulic Machines", New India Publishing House, Delhi, 2014.
6. A. Kumar, H. K. Dhingra, "Materials and Metallurgy", Dhanpat Rai and Co., Delhi, 2011.
7. MK Garg and Sandeep Bajaj, "Strength of Materials ", North Publication, Jalandhar. 2013.
8. Bharat Bhushan and R. C. Jindal, "Theory of Machines", Ishan Publication, Jalandhar, 2013.
9. Sandeep Bajaj, "Refrigeration & Air Conditioning ", Ishan Publications, Jalandhar. 2012.

INSTRUCTIONAL STRATEGY

The contents will be covered through lecture cum discussion sessions. Besides this live demonstration of the machines and familiarize with different labs of the institute be done. Also the visits to the nearby industries be arranged so that students are able to understand in a clear and better way. 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 units of equal weightage.

2.4 ENVIRONMENTAL STUDIES AND DISASTER MANAGEMENT

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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 in the 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: Clarify interdisciplinary nature of environmental issues.
CO3: Describe corrective measures for the abatement of pollution.
CO4: Identify the role of non-conventional energy resources in environmental protection.
CO5: Recognize various types of disasters.

DETAILED CONTENTS

UNIT I

Introduction

1.1 Basics of ecology, eco system- 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, Earthquakes 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, Rumour and Panic)

RECOMMENDED BOOKS

1. S.C. Sharma & M.P. Poonia, “Environmental Studies”, Khanna Publishing House, New Delhi.
2. BR Sharma, “Environmental and Pollution Awareness”, Satya Prakashan, New Delhi.
3. Dr. RK Khitoliya, “Environmental Pollution”, S Chand Publishing, New Delhi.
4. Erach Bharucha, “Environmental Studies”, University Press (India) Private Ltd., Hyderabad.
5. Suresh K Dhamija, “Environmental Engineering and Management”, S K Kataria and Sons, New Delhi.

6. E-books/e-tools/relevant software to be used as recommended by AICTE/BTE/NITTTR, Chandigarh.
7. Dr. Mrinalini Pandey, “Disaster Management”, Wiley India Pvt. Ltd.
8. Tushar Bhattacharya, “Disaster Science and Management”, 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 weightage.

2.5 CROP PRODUCTION

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RATIONALE

A diploma holder in Agricultural Engineering needs to learn about package of practices for various seasonal crops besides becoming familiar with the preparation of cost estimates for production of these crops. After studying the subject of crop production, the diploma holder will acquire adequate knowledge and skills of crop production and cropping system, soil fertility and weed management besides plant protection and crop harvesting. Hence this subject.

COURSE OUTCOMES

After undergoing this subject, the students will be able to:
CO1: Explain the factors affecting crop production.
CO2: Explain various systems of cropping.
C03: Explain various methods of tillage.
C04: Explain various methods of seed placement in soil.
C05: Use various methods of irrigation.
C06: Use various methods of weed control and fertilisers.
C07: Use various methods of harvesting crops.

DETAILED CONTENTS

UNIT I

1. Introduction

Agriculture, importance of agriculture, Crop production Art, Science and business, Factors affecting crop production viz. Internal and external factors. Classification of crops based on their utility and seasons of growing. Major and principal crops of the country and Haryana state.

UNIT II

2. Crop Rotation and Cropping System

Crop rotation, Principles of crop rotation, advantages of crop rotation and rotational intensity. Cropping scheme and principles of cropping scheme. Cropping intensity. Systems of cropping viz. mixed

cropping and intensive cropping. Principles of mixed cropping and its advantages. Pre-requisites of intensive cropping and methods of intensive cropping viz. multiple & intercropping. Crop diversification.

UNIT III

3. Seed Bed Preparation

Tillage, definition, function and importance of tillage. Types and methods of tillage. Effect of tillage on the soil characteristics and nutrient availability in soil.

4. Sowing / Placement of Seeds

Characteristics of good seed, types of seeds viz. Breeder's, Nucleus, and Foundation and Certified seeds. Seed treatment. Factors affecting seed germination. Different methods of seed placement in the soil.

5. Irrigation and Water Application

Importance of water for plants, necessity of water application. Critical stages (growth) of water application .Sources of irrigation water. Methods of irrigation (names only). Factors affecting selection of method viz. crop, soil, source of water.

UNIT IV

6. Interculture and Weed Management

Importance of intercultural operations in crop productions. Introduction with the methods, tools and equipment required for interculture. Weed, classification, useful and harmful effects. Methods of weed control viz. mechanical, biological, agronomical (crop competition and rotation), firing and chemical.

7. Soil Fertility Management

Plant nutrient elements, their classification viz. Macro, Secondary & Micro and their importance. Soil fertility, Types of Fertilizers and Manners used to maintain soil fertility. Methods of application, tips for safe storage and better handling of fertilizers. Organic fertilizers and their advantage.

UNIT V

8. Plant Protection

Various factors/agents causing damage to the crop viz. Pests, Diseases etc. Introduction with the ecofriendly pest- management practices and the chemicals used for control of diseases, bio-pesticides.

9. Harvesting

Various methods of harvesting of different crops. Factors affecting harvesting viz. time of maturity, moisture contents, climates factors etc.

10. Practices/Cultivation Details/Modern Techniques

Package of practices/cultivation details/important modern techniques for raising Wheat, Paddy, Maize, Gram, Mustard, Cotton grown in Haryana.

PRACTICAL EXERCISES

1. Identification of crops and their seeds.
2. Identification of different types of fertilizers.
3. Identification of different crop weeds and methods of weed control.
4. Practices of fertilizer application.
5. Methods of seed bed preparation.
6. Methods of sowing/planting.
7. Visits to the mechanized/modernized farms of agricultural universities/center-state farms for the study of growth phases in various crops and to get the exposure of modern techniques being used for raising different crops.
8. Study of Vermicomposting and visits to agriculture farms.
9. Estimation of different entities required for crop production and estimation of yield of crops.
10. Identification of different diseases and insect-pests of major field crops.

RECOMMENDED BOOKS

1. Chatterjee, “Cropping System Theory & Practice”, Oxford & IBH Publication Co., Edition 1991.
2. Y.B. Morachan, “Crop Production & Management”, Oxford & IBH Publication Co., Edition 2019.
3. S.S. Singh, “Principles & Practices of Agronomy”, Kalyani Publishers, New Delhi, Edition 2016.
4. Jagadish Jena & Twinkle Jena, “Glimpses of Crop production”, Jain Brothers, Edition 2020.
5. Jagdishwar Sahay, “Elements of Agriculture Engineering”, Standard Publishers Distributors, Delhi, Edition 2009.

INSTRUCTIONAL STRAGEGY

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 units of equal weightage. Students should be taken to agricultural farms for demonstration of various operations and use of charts and video films be made during teaching-learning process.

2.6 WORKSHOP PRACTICE – I

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RATIONALE

In order to have a balanced overall development of diploma engineers, it is necessary to integrate theory with practice. This course is included in the curriculum in order to provide hands-on experience about basic manufacturing practices. This subject aims at developing general manual skills in the students. In addition, the development of dignity of labour, safety at work place, team working and development of right attitude are the other objectives.

COURSE OUTCOMES

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

CO1: Identify tools, equipment and materials used in preparing jobs.

CO2: Take measurements with the help of basic measuring tools/equipment.

CO3: Select materials, tools, and sequence of operations to make a job as per given specifications/drawing.

CO4: Prepare simple jobs independently and inspect the same.

CO5: Use safety equipment and Personal Protection Equipment (PPE).

CO6: Maintain good housekeeping practices.

PRACTICAL EXERCISES

The following shops are included in the syllabus.

1 Welding Shop – II
2 Fitting and Plumbing Shop – II
3 Carpentry Shop II
4 Smithy Shop
5 Electric and Electronics Shop II
6 Turning Shop

1. WELDING SHOP – II

1.1 Safety Precautions of concerned shop and use of personal protective equipment (PPE), demonstration of tools, equipment, sample jobs, Best practices in the concerned shop.

1.2 Introduction to gas welding, gas welding equipment, introduction to soldering and brazing, introduction to resistance welding, safety precautions.

1.3 Identification and adjustment of various types of gas flames

1.4 Demonstration of brazing and gas cutting

1.5 Demonstration of Welding defects

1.6 Jobs to be prepared

Job I Beading Practice by gas welding.

Job II Preparation of lap joint on M.S. flat using gas welding.

Job III Preparation of double V butt joint/corner joint on M.S. flat using gaswelding / arc welding process

Job IV Preparation of pipe joint using gas/arc welding

Job V Preparation of a small cot frame/stool/table frame/drawing tableframe) using gas or arc welding.

2. FITTING AND PLUMBING SHOP – II

2.1 Safety Precautions of concerned shop and use of personal protective equipment (PPE), demonstration of tools, equipment, sample jobs, Best practices in the concerned shop.

2.2 Handling of measuring instruments, Use of dial gauges and feeler gauges.

2.3 Demonstration of various types of drills, taps and dies.

2.4 Introduction to tapping and dieing

Job I To perform drilling and reaming operation on mild steel flat.

2.5 File and make angle, surfaces (Bevel gauge accuracy 1 degree) make simple open and sliding fits Inside square fit, make combined open and sliding fit, straight sides

Job II To make assembly for V shape or square shape fit.

Job III Radius form filing on the corners

2.6 Sliding fitting, Diamond fitting, Lapping flat surfaces using lapping plate. Application of lapping, material for lapping tools, lapping abrasives, charging of lapping tool. Surface finish importance, equipment for testing-terms relation to surface finish

Job IV To make step assembly.

2.7 Introduction to various types of threads (internal and external)-single start, multi-start,left hand and right hand threads.

2.8 Description and demonstration of various types of drills, taps and dies. Selection ofdies for threading, selection of drills, taps and reamers for tapping operations.

2.9 Introduction to use of plumbing tools like pipe wrench , plumber vice and materials likePutty, thread, duct(Teflon) tape, epoxy resin, araldite, m-seal.

2.10 Precautions while drilling soft metals, e.g. copper, brass, aluminium etc.

Job V To make overhead tank assembly with GI/C-PVC pipes and joints.

3. CARPENTRY SHOP – II

3.1 Safety Precautions of concerned shop and use of personal protective equipment (PPE), demonstration of tools, equipment, sample jobs, Best practices in the concerned shop.

3.2 Introduction to joints, their relative advantages and uses.

Job I To make a dovetail joint.

Job II To make a mitred joint.

Job III To make a lengthening joint by using different joints.

3.3 Demonstration of machines like Band Saw and Circular Saw, Chain and Chisel, Universal wood working machine, Saw re-sharpening machine, Saw Brazing unit.

3.4 Introduction and function of various parts of Wood Working Lathe

a) Study of wood working lathe tool.

b) Sharpening of lathe tools.

c) Setting of jobs and tools.

Job IV To make a job using different type of wood turning operations including form turning and grooving.

OR Repair of any utility item.

Job V To make a medium size wooden dust bin/ wooden tray.

4. SMITHY SHOP

4.1 Safety Precautions of concerned shop and use of personal protective equipment (PPE), demonstration of tools, equipment, sample jobs, Best practices in the concerned shop.

4.2 Introduction and industrial applications of smithy jobs.

4.2.1 Purpose of Smithy shop.

4.2.2 Different types of Hearths used in Smithy shop, Types of fuel used and maximum temperature obtained.

4.2.3 Purpose, specifications, uses, care and maintenance of various tools and equipment used in hand forging by segregating as cutting tools, supporting tools, holding tools, measuring tools, punches etc.

4.2.4 Types of raw materials used in Smithy shop.

4.2.5 Uses of Fire Bricks and Clays in Forging workshop.

4.3 Practice

4.3.1 Practice of firing of hearth/Furnace, Cleaning of Clinkers and Temperature Control of Fire.

4.3.2 Practice on different basic Smithy/Forging operations such as Cutting, Upsetting, Drawing down, Setting down, Necking, Bending, Fullering, Swaging, Punching and Drifting. Demonstration of making cube, hexagonal cube, hexagonal bar from round bar

4.3.3 Practice of Simple Heat treatment processes like Tempering, Normalizing, and Hardening.

4.4 Introduction to various heat treatment processes e.g annealing, hardening, tempering, normalizing.

4.5 Description of various types of power hammers and their usage (Demonstrationonly).

4.6 Jobs to be prepared

Job I To forge a square/hexagonal shape on both endsfrom a MS round by cold forging

Job II To make a utility item like fan hook, ring, U type door handle

Job III To make a ring of MS round by forge welding

Job IV To make a hexagonal chisel by hot forging process withhardening and tempering

Job V To perform bending process by hot forging.

5. ELECTRICAL AND ELECTRONICS SHOP – II

5.1 Safety Precautions of concerned shop and use of personal protective equipment (PPE), demonstration of tools, equipment, sample jobs, Best practices in the concerned shop.

5.2 Introduction to single phase and three phase supply and wiring system. Importance of three phase supply (RYB) and its sequence and wiring system. Estimating and costing of power consumption.

Job I Connecting single phase energy meter with supply and load. Reading and working out power consumption and cost of energy.

5.3 Study of internal wiring diagram of common electrical appliances such as auto electric iron, electric kettle, ceiling/table fan, desert cooler etc. Demonstration of dismantling, servicing and reassembling of table/ceiling fan, air-cooler, auto electric iron, heater etc.

Job II Connection of single phase/three phase motor by using starter. Reversing direction of rotation of single phase and three phase motors.

Job III Cut, bend, tin components, leads, inserts. Solder components for example resistor, capacitor, diode, transistor and other components ona PCB.

5.4 Demonstrate the joining for connecting methods mounting and dismounting method as well as using of the various plugs, sockets, conductors, suitable for general purpose, audio video used conductors, banana plugs, socket and similar male and female conductor and terminal strips

5.5 Various types of switches such as normal, miniature toggle, slide, push button.

Job IV Wiring of a small circuit on a PCB/ TAG strip involving laying, sleeving and use of identifier tags.

Job V Cut, strip, join and insulate two lengths of wires/cables.

Desoldering practice with desoldering pump and desoldering wick.

6. TURNING SHOP

6.1 Safety Precautions of concerned shop and use of personal protective equipment (PPE), demonstration of tools, equipment, sample jobs, best practices in the concerned shop.

6.2 Jobs to be Prepared

Job 1 Centering practice in 4 jaw chuck, setting of cutting tool point at appropriate height and perform facing and plain turning operationson MS rod.

Job II To sharpen various angles of turning tool.

Job III To perform step turning on MS rod.

Job IV To perform taper turning and under cutting operation.

Job V To perform step turning and knurling operation on MS rod.

RECOMMENDED BOOKS

1. SK Hajra Choudhary and AK Choudhary, “Workshop Technology I, II, III”, Media Promoters and Publishers Pvt. Ltd., Mumbai, Fifteenth Edition, 2016.
2. RK Jain, “Workshop Technology Vol I& II’’, Khanna Publishers, New Delhi, First Edition, 2021.
3. Manchanda, “Workshop Technology Vol. I, II, III”, India Publishing House, Jalandhar.
4. S.S. Ubhi, “Workshop Training Manual Vol. I, II’’, Katson Publishers, Ludhiana.
5. K Venkata Reddy, “Manual on Workshop Practice”, MacMillan India Ltd., New Delhi, Sixth Edition, 2020.
6. “General Workshop Manual (Diploma Jobs)”, Khanna Publishers, First Edition, 2021.
7. T Jeyapoovan, “Basic Workshop Practice Manual”, Vikas Publishing House (P) Ltd., New Delhi.
8. B. S. Raghuvanshi, “Workshop Technology, Vol. I”, Dhanpat Rai and Sons, Delhi, Eleventh Edition, 2017.
9. Kannaiah K L, Narayana, “Workshop Manual”, Scitech Publications, Chennai, Second Edition 1998.

10. H S Bawa, “Workshop Practice”, Tata McGraw Hill Publication, First Edition, 2004.

INSTRUCTIONAL STRATEGY

This is hands-on practice based workshop for development of required skills in the students.

SECOND YEAR

NSQF LEVEL - 4

12. STUDY AND EVALUATION SCHEME

THIRD 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	Tot	Th	Pr	Tot	
3.1	Industrial/In-house Training I	-	2	0+1=1	-	40	40	-	60	60	100
3.2	Farm Irrigation Engineering	4	3	4+2=6	40	40	80	60	60	120	200
3.3	IC Engine	3	3	3+2=5	40	40	80	60	60	120	200
3.4	Farm Machinery and Implements - I	4	3	4+2=6	40	40	80	60	60	120	200
3.5	Post-Harvest Technology	4	3	4+2=6	40	40	80	60	60	120	200
3.6	Open Elective (MOOCs+/Offline)	2	-	2+0=2	40	-	40	60	-	60	100
# Student Centered Activities(SCA)		-	4	-	-	-	-	-	-	-	-
	Total	**17**	**18**	**26**	200	200	400	300	300	600	1000

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

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

FOURTH 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	Tot	Th	Pr	Tot	
4.1	*English & Communication Skills - II	2	2	2+1=3	40	40	80	60	60	120	200
4.2	Agro Process Engineering	4	4	4+2=6	40	40	80	60	60	120	200
4.3	Manufacturing Technology	4	4	4+2=6	40	40	80	60	60	120	200
4.4	Soil and Water Conservation	4	-	4+0=4	40	-	40	60	-	60	100
4.5	Computer Aided Design in Agriculture Engineering	-	4	0+2=2	-	40	40	-	60	60	100
4.6	**Programme Elective	3	-	3+0=3	40	-	40	60	-	60	100
# Student Centered Activities(SCA)		-	4	-	-	-	-	-	-	-	-
	Total	17	18	24	200	160	360	300	240	540	900

* Common with other Diploma Courses

** **Programme Elective**:- **4.6.1** Green House Technology **4.6.2** Solar Technology

\# Student Centered Activities will comprise of co-curricular activities like extension lectures on Constitution of India, Electoral Literacy, Motor Vehicles (Driving) Regulations 2017 etc., 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 Weeks.

13. HORIZONTAL AND VERTICAL SUBJECTS ORGANISATION

Sr. No.	Subjects	Hours Per Week	
		Third Semester	Fourth Semester
1.	Industrial Training/In-house Training I	2	-
2.	Farm Irrigation Engineering	7	-
3.	IC Engine	6	-
4.	Farm Machinery and Implements - I	7	-
5.	Post-Harvest Tech.	7	-
6.	Open Elective (MOOCs/Offline)	2	-
7.	English & Communication Skills - II	-	4
8.	Agro Process Engineering	-	8
9.	Manufacturing Technology	-	8
10.	Soil and Water Conservation	-	4
11.	Computer Aided Design in Agriculture Engineering	-	4
12.	Programme Elective	-	3
13.	Student Centered Activities(SCA)	4	4
	Total	**35**	**35**

14 COMPETENCY PROFILE & EMPLOYMENT OPPORTUNITIES

Government and private sectors related to Agriculture Engineering require **skilled workers** to work in familiar, predictable, routine situations of clear choice. They are expected to have factual knowledge of Agriculture Engineering field. They will be able to write and speak with required clarity. Students after passing level 4 shall have understanding of basic arithmetic, algebraic principles along with basic understanding of social and natural environment. They are expected to recall and demonstrate quality skill in narrow range of applications using appropriate rules and tools.

Skilled workers 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. They should know what constitutes quality in the occupation and should distinguish between good and bad quality in the context of their job roles. Skilled worker 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 should 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.

Agriculture Engineering NSQF Level – 4 pass out students are expected have the knowledge of farm irrigation engineering and farm machinery implements. They are expected to have good knowledge of agro process engineering and post-harvest technology. They are expected to have skills in computer aided design of components. Level 4 pass out students should have good knowledge and skills regarding working of various machines used in manufacturing operations.

Agriculture Engineering students have wide scope to work in agriculture machinery manufacturing units, agro processing units and agriculture implements manufacturing units. They also have good avenues in establishing small startups in the area of marketing and sales, manufacturing units and repair and maintenance units etc.

14. 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 this level, the student will be able to:

PO1: Carry out a task which may require limited range of predictable activities.

PO2: Acquire knowledge of basic facts, process and principles related to Agriculture Engineering for employment.

PO3: Demonstrate Practical skill in narrow range of Agriculture Engineering applications.

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

PO5: Perform task under close supervision with some responsibility for own work within defined limit.

PO6: Select open elective of own interest to develop self-learning through MOOCs.

14. ASSESSMENT OF PROGRAMME AND COURSE OUTCOMES

Programme Outcomes to be Assessed	Assessment Criteria for the Course Outcomes
PO1: Carry out a task which may require limited range of predictable activities.	• Assist in testing an IC engine. • Take necessary safety precautions and measures. • Work in team for solving industrial problems • Develop competencies and skills required by relevant industries.
PO2: Acquire knowledge of basic facts, process and principles related to Agriculture Engineering for employment.	• Understand the working environment of industries. • Learn about present and future requirement of industries. • Gain basic knowledge of irrigation system. • Explain the necessity and methods of irrigation. • Explain the irrigation water requirements and irrigation efficiencies. • Interpret various terms related to well hydraulics. • Explain the working of IC engine and functioning of various parts of IC engine. • Explain various thermodynamic cycles. • Explain the working of fuel system of diesel engine. • Explain the working of cooling and lubrication system in IC engine. • Explain various types of drives for power transmission. • Explain the concept of balancing and vibrations in machines. • Explain functions of shaft coupling, bearing and pipe joints in agriculture machinery.

	• Classify various implements/equipment used in farming operations. • Explain constructional details and working of tillage implements. • Explain various post harvesting operations. • Understand the engineering properties of agricultural materials. • Explain principle of operation of various dryers. • Explain the steps in processing of seeds of cereals, pulses and cotton. • Explain the rice milling process. • Describe various pulse milling methods. • Explain steps involved in wheat milling. • Explain principle of operation of various devices used in oil milling. • Understand the operation of machines used in animal feed plant. • Use various measuring instruments and gauges. • Explain the working principle of metallic coating and finishing processes. • Explain the process of pattern making, moulding and casting • Explain the working of various machining processes such as lathe, drilling, boring, grinding and milling. • Carry out welding of jobs. • Understand properties of soil in relation to plant growth. • Explain the mechanism of soil erosion due to water and wind. • Take various measures for erosion control.

	• Explain various methods of water harvesting. • Reclaim salt affected soils. • Explain causes of water logging and methods of drainage. • Classify green houses based on shape, utility, construction and covering material. • Describe features, components and design criteria of green house • List factors that affect greenhouse environment. • Describe working of advance irrigation systems in greenhouse. • Comprehend importance of repair and maintenance of green houses. • Explain the working principle of solar cell. • Explain the working of various solar collectors. • Describe the methods to store the solar energy. • Explain the working principle of various solar energy based appliances.
PO3: Demonstrate Practical skill in narrow range of Agriculture Engineering applications.	• Understand the working environment of industries. • Take necessary safety precautions and measures. • Work in team for solving industrial problems • Develop competencies and skills required by relevant industries. • Undertake operation and maintenance of pumps. • Use various methods for water measurement in pipes and open channels. • Assist in testing an IC engine. • Demonstrate the working of seeding and

	planting machinery and their adjustment. • Provide post harvest treatment to fruits and vegetables. • Use various measuring instruments and gauges. • Carry out welding of jobs. • Handle CAD software by using different commands. • Prepare drawings of various mechanical components using Auto CAD. • Use commands for dimensioning and hatching.
PO4: Demonstrate skill of communication, basic mathematics, collecting and organizing information along with knowledge of social, political and natural environment.	• 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. • Take various measures for erosion control. • Explain various methods of water harvesting. • List factors that affect greenhouse environment.

PO5: Perform task under close supervision with some responsibility for own work within defined limit.	• Assist in testing an IC engine. • Demonstrate the working of seeding and planting machinery and their adjustment. • Manage storage of cereals, pulses, fruits and vegetables. • Take necessary safety precautions and measures. • Work in team for solving industrial problems • Develop competencies and skills required by relevant industries.
PO6: Select open elective of own interest to develop self-learning through MOOCs.	• State the basic concepts and principles about the subject of interest. • Perform in a better way in the professional world. • Select and learn the subject related to own interest. • Explore latest developments in the field of interest. • Develop the habit of self-learning through online courses.

17. SUBJECTS & CONTENTS

(SECOND YEAR)

THIRD SEMESTER

3.1 INDUSTRIAL/IN-HOUSE TRAINING- I

L	P
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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 training, 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 FARM IRRIGATION ENGINEERING

L	P
4	3

RATIONALE

A diploma holder in agriculture engineering needs to learn the principles pertaining to the optimum use of water for maximum agricultural yield besides understanding engineering principles related to surface and ground water resources. After studying this subject, the students shall acquire adequate knowledge and skills about water requirement of crops and water lifting devices.

COURSE OUTCOMES

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

CO1: Gain basic knowledge of irrigation system.
C02: Explain the necessity and methods of irrigation.
CO3: Explain the irrigation water requirements and irrigation efficiencies.
C04: Undertake operation and maintenance of pumps.
C05: Interpret various terms related to well hydraulics.
C06: Use various methods for water measurement in pipes and open channels.

DETAILED CONTENTS

UNIT I

1. Introduction

Sources of surface water resources, irrigation, necessity of irrigation and advantages and disadvantages of irrigation. Types of irrigation viz. artificial (flow, lift etc.) and natural. Sources and quality of irrigation water.

2. Irrigation Water Requirement and Efficiencies

21 Evaporation, Transpiration, Transpiration Ratio, evapotranspiration or consumptive use, seasonal consumptive use, peak period consumptive use. Factors affecting consumptive use of water.

22 Water infiltration and infiltration rate. Crop water requirement, net and gross irrigation requirement. Irrigation frequency, Irrigation scheduling.

2.3 Duty and Delta; factors affecting duty and methods of improving duty.

2.4 Irrigation efficiencies- water conveyance, application, storage, distribution, water use, project, operational and economic efficiency.

UNIT II

3. Water Application Methods

3.1 Introduction to surface, subsurface, sprinkler and drip irrigation systems.

3.2 Surface methods of irrigation viz. border, check basin and furrow irrigation, their basic details, characteristics, types and their adaptability.

3.3 Sprinkler irrigation-its adaptability and limitations, types, components, operation and maintenance of sprinkler systems.

3.4 Drip irrigation- its adaptability and limitations, types, components, operation and maintenance of drip irrigation systems.

UNIT III

4. Water Pumps

4.1 Introduction to various pumps used for irrigation.

4.2 Classification of pumps-positive displacement (reciprocating and rotary), variable displacement.

4.3 Pumps and Terminology, Centrifugal pumps (volute and diffuser type, single stageand multistage type), Types of impellers of centrifugal pump. Installation, operation and maintenance of centrifugal pumps.

4.4 Submersible pump and vertical turbine pumps; their common troubles and remedies.

4.5 Criteria and procedures for selection of irrigation pumps.

UNIT IV

5. Well Hydraulics, Open Wells and Tube Wells

5.1 Types of water bearing formations (confined, unconfined aquifer etc.) aquifer characteristics influencing yield of wells. Determination of aquifer constant, specific capacity of wells.

5.2 Different terms related to well hydraulic such as water tables, isobath, isobar lines , draw down. Recharge of ground water.

5.3 Types of wells, open wells & Tubewells (Introduction only), well development & its methods.

UNIT V

6. Conveyance and Measurement of irrigation water

6.1 Canals and their classification (brief description only), seepage from canals and field channels. Canal lining-various types. Their advantages and disadvantages.

6.2 Introduction to various water conveyance structures (Precast concrete channel sections, Drop and Chute Spillway) and their functions. Open channels, their types, layout and design parameters.

6.3 Subsurface systems of water conveyance, their components.

6.4 Units of water measurement, direct and indirect methods of water measurement. Measurement of water in pipes and open channels.

7. Environment Issues

Pollution with poor quality irrigation water and excessive use of fertilizer and agro- chemicals.

INSTRUCTIONAL STRETAGY

Irrigation area from state Govt. departments like Agriculture, Irrigation and Public Health, Tubewell Corporation etc. may be consulted. Water Conveyance Structures need to be studied in the agriculture farm. Pressurized Irrigation system installed in the farm/industry for problems and constraints. This subject contains five units of equal weight age.

PRACTICAL EXERCISES

1. Study/Demo of constructional features of Sprinkler irrigation system, its operation and maintenance.
2. Study/Demo of constructional features of Drip irrigation system, its operation and maintenance.
3. Study/Demo of constructional feature of Centrifugal pump, its operation and maintenance. Identifying/locating the faults/troubles and remedies.
4. Installation, operation & maintenance of submersible pump. Identifying/locating the faults/troubles and remedies.
5. Measurement of water flow using Parshall flume.
6. To survey market and field for the availability, adaptability and selection of various types of pumps and irrigation systems in the region.
7. Exposure visit to irrigation equipment industries: pumps, sprinkler and drip system etc.

RECOMMENDED BOOKS

1. Chatterjee, “Cropping System Theory & Practice”, Oxford & IBH Publication Co.
2. Dr. A.M. Michael, “ Irrigation Theory and Practice” , Vikas Publishing House, New Delhi
3. B.C. Punia, Dr. Pandey, B.B. Lal , “Irrigation and Water Power Engineering” , Standard Publication.
4. Parveen Kumar, “Ground Water and Well Drilling”, CBS Publishers and Distributors, Delhi.
5. Sivanappan, “Sprinkler Irrigation”, Oxford & IBH Publication Co.
6. M. Lal et al, “Irrigation Engineering”, New India Publishing House.
7. A.M. Michael & S.P. Khepar, “Water well & Pump Engineering”, Tata McGraw Hill Publishing Co. Ltd., New Delhi.

3.3 IC ENGINE

L	P
3	3

RATIONALE

The IC engines are the primary source of mechanical power for tractors and all other allied purposes. This course will enable the students to understand the principle of working and construction of IC engines.

COURSE OUTCOMES

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

CO1: Explain the working of IC engine and functioning of various parts of IC engine.
CO2: Explain various thermodynamic cycles.
CO3: Explain the working of fuel system of diesel engine.
CO4: Explain the working of cooling and lubrication system in IC engine.
CO5: Assist in testing an IC engine.

DETAILED CONTENTS

UNIT I

1. Principles of IC Engines

Introduction and classification of IC engines. Various parts of IC engines, their location, function and material used for them. Working principle of four stroke and two stroke cycle. Petrol and Diesel engines, their comparison. Concept of IC engine terms , bore, stroke, dead centre, crank throw, compression ratio, clearance volume, piston displacement and piston speed . Working principle of rotary (Wankle) engine.

UNIT II

2. Thermodynamics Cycles

Otto or Constant Volume cycle, Diesel or Constant Pressure Cycle , Dual cycle or Limited Pressure cycle and their thermal efficiencies. Applications of I.C. Engines.

3. Air Intake System

Components of air intake system viz. pre-air cleaner, inlet manifold, exhaust manifold, types of air cleaners: wet, dry

UNIT III

4. Fuel System in Diesel Engine

Components of fuel system, description and working of fuel feed pump, working of fuel injection pump, injector, fuel filters, complete detail and working of micro fuel injection system for a multi cylinder engine, use of alternate fuels in IC engines i.e. biogas, gasoline, biomass fuel (wood).

UNIT IV

5. Cooling and Lubrication

Necessity of engine cooling, Types of cooling systems (Air cooled and Water Cooled) and their components. Defects in cooling system and their rectification. Thermostat valve and its function. Functions of lubrication, types and properties of engine lubricants, additives for improving the properties, lubrication system of IC engine and its types, oil pumps, oil filters, pressure relief valve , positive crank case ventilation.

UNIT V

6. IC Engine Testing and Pollution Control

Engine power, indicated and brake power, efficiency – mechanical, thermal, relative and volumetric efficiencies, methods of finding indicated and brake horse power, Morse test and heat balance sheet performance and endurance tests of IC engine.

Concept of pollutants in CI engines, exhaust smoke analysis and pollution control, Bharat stage emission standards (BS Norms), Methods of reducing pollution in IC engines.

Preventive Maintenance, repair and overhaul of engines

INSTRUCTIONAL STRAGEGY

Cut section/models may be used for explaining different components of engine. Visits may be arranged to nearest tractor/engine repair workshop. This subject contains five units of equal weight age.

PRACTICAL EXERCISE

1. Study of two stroke engine using cut section model, note the function and material of each part.
2. Study of four stroke engine using cut section model, note the function and material of each part.
3. Identification of various tools used for dismantling and assembling IC engines
4. Performing pre-starting checks on engine
5. Study of fuel injection system of multi cylinder engine, dismantling and reassembling.
6. Study of cooling system of I C engine.
7. Study of lubrication system of IC engine.
8. Trouble shooting of IC engines.
9. Visits to I.C. Engine repair shops.

RECOMMENDED BOOKS

1. S.C. Jain and Rai, "Farm Tractors", Tata Oxford Company.
2. Jagdishwar Sahay, " Elements of Agriculture Engineering", Standard Publishers Distributors, New Delhi
3. A. M. Michael, & T.P. Ojha, "Principles of Agriculture Engineering Vol-I " , Jain Brothers , New Delhi.
4. Sandeep Bajaj, and Sanjay Kajal, "Thermodynamics –II (Thermal Engineering)" , Ishan Publications , Ambala City.

3.4 FARM MACHINERY AND IMPLEMENTS - I

L	P
4	3

RATIONALE

The topics covered in the subject will enable the students to understand the basic principles, construction and working of farm machinery for different crops. This will also enable them to select appropriate machinery, use, repair and maintain the same. This knowledge will be highly useful in running an Enterprise related with Farm Machinery and employment in Farm Mechanization sectors. In view of its importance and lengthy curriculum this course will be taught partly in two semesters Farm Machinery and Implements -I & II

COURSE OUTCOMES

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

CO1: Explain various types of drives for power transmission.
CO2: Explain the concept of balancing and vibrations in machines.
CO3: Explain functions of shaft coupling, bearing and pipe joints in agriculture machinery.
CO4: Classify various implements/equipment used in farming operations.
CO5: Explain constructional details and working of tillage implements.
C06: Demonstrate the working of seeding and planting machinery and their adjustment.

DETAILED CONTENTS

UNIT I

1. Mechanical Principles

1.1 Simple Mechanisms

Introduction to Mechanism, Machine, Structure, Element & Link.

1.2 Power Transmission in Farm Machinery

Flat and V-Belt Drive, Chain & Sprocket Drive, Gear Drive, Types of gear. Effect of Centrifugal Tension, Horse Power transmitted, Conditions for maximum power transmission. Introduction to Belt dynamometer (No derivation)

1.3 Balancing & Vibration

Concept of Balancing, Static & Dynamic Balancing, Concept of Vibration, Types of vibrations: Longitudinal, Transverse & Torsional, Causes of vibration in machines, their

harmful effects & remedies.

1.4 Shaft Couplings, Bearings & Pipe Joints

Couplings, their functions and use (Oldham and Universal Coupling), Bearings their functions and use (Bush Bearing & Plummer Block), Pipe Joints & their use in Agricultural machinery (Flanged, Socket & Union joint)

UNIT II

2. Introduction to Farm Machinery

Introduction and brief history of the traditional tools and equipments used in farming operations. Farm Mechanization-Scope & Limitation, Classification of Farm Machinery according to operation (seed bed preparation, sowing, harvesting, threshing etc.). Classification of Farm Machinery/ Implements according to hitching (Trailed, Semi mounted & mounted type). Drawbar, 2-point & 3-point linkage.

Introduction to Tillage, Objectives of Tillage. Types of Tillage.

Introduction to different types of tillage implements and their classification.

UNIT III

3. Primary Tillage Implements

3.1 Primary Tillage Implements

Mould Board Plough- Constructional details & Components & its different types, Adjustments of M. B. Plough (Horizontal suction, Vertical suction etc.) Plough accessories (Jointer, Coulter etc.),

3.2 Mechanics of Ploughs, Size, capacity and power requirements of plough.

Disc Plough- Constructional details & Components , different types of disc plough- Standard disc plough and Vertical disc plough, Adjustments of Disc Plough (Disc angle, Tilt angle)

3.3 Adaptability of Mould board Plough and their comparison

3.4 Introduction and use of Indigenous Plough, Chisel Plough, Subsoiler and Rotary Plough

UNIT IV

4. Secondary Tillage Implements

4.1 Introduction to various types of Harrow- Constructional details & components and working of Disc Harrow, Spike tooth harrow, Spring tooth harrow, Triangular harrow, Blade harrow, Zigzag Harrow, Rolling harrow, Reciprocating harrow, Cage Harrow.

4.1 Introduction to different types of cultivators, their functionsand constructional details.

4.2 Rotavator- Constructional details, Principle of operation & functions, Advantages over

other tillage implements

4.3 No tillage/ Zero tillage machinery – Zero till drill, Strip till drill etc

UNIT V

5 Seeding & Planting Machines & Equipment

5.1 Introduction to different types of Seeding/ Planting Methods .

5.2 Seed drills and Seed cum fertilizers drills, their functions, Constructional details, components & working. Different types of seed metering mechanisms and furrow openers used in seed drills.

5.3 Planter- Introduction to planters for different crops. Main Components and functions of a planter. Different types of seed metering mechanisms used in planters.

5.4 Study of Potato Planter, Sugarcane planter.

5.5 Adjustments of seed drills and planters for depth of sowing and sowing rate and Calibration of seed drills and planters.

5.6 Transplanter - Functions, working, components & constructional details of Paddy transplanter.

INSTRUCTIONAL STRATEGY

Drawing of various machines may be used to illustrate the constructional details of Machinery & equipment. Besides this live demonstration of the machines & visits to the local units manufacturing these implements/ machines be arranged so that students are able to understand in a clear and better way. This subject contains units of equal weight age.

PRACTICAL EXERCISE

1. Study of constructional features, working and adjustments of Mould Board Plough.
2. Study of constructional features, working and adjustments of Disc Plough.
3. Study of constructional features and working of Disc Harrow.
4. Demonstration of constructional features, working and adjustments of Seed cum fertilizer drill.
5. Study of constructional features, working and adjustments of Zero till drill.
6. Demonstration/Study of constructional features, working and adjustments of Potato planter/ Sugarcane Planter.
7. Study of constructional features, working and adjustments of Paddy Transplanter.

8. Tractor driving practice.
9. Hitching and de hitching of different implements with the tractor.

RECOMMENDED BOOKS

1. Dr. Jagdishwar Sahay, "Elements of Agricultural Engineering", Standard Publisher Distributors, Nai Sarak, Delhi.
2. R.A. Kepner, Roy Bainer and E.H. Barger, "Principle of Farm Machinery", CBS Publishers and Distributors, Delhi.
3. A. M. Michael & T.P.Ojha, Principles of Agriculture Engineering Vol-I " , Jain Brothers , New Delhi
4. C.P. Nakra , " Farm Machines & Equipments" , Dhanpat Rai & Sons ,Nai Sarak New Delhi.
5. Dr. O.P. Singhal and Naresh Chandra Aggarwal, "Elements Of Agricultural Engineering Part 1 & 2", Saroj Prakashan, Allahabad.
6. Smith , " Farm Machinery and Equipments", Tata McGraw Hill Publishing Company Ltd., New Delhi

3.5 POST-HARVEST TECHNOLOGY

L	P
4	3

RATIONALE

Agricultural produce e.g. cereal, pulses and oil seeds are not consumed as such. They are processed before consumption. Knowledge of unit operation such as drying, storage and processing of fruits and vegetables is of great importance for value addition of these food products.

COURSE OUTCOMES

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

CO1: Explain various post harvesting operations.
CO2: Understand the engineering properties of agricultural materials.
CO3: Explain principle of operation of various dryers.
CO4: Manage storage of cereals, pulses, fruits and vegetables.
CO5: Provide post harvest treatment to fruits and vegetables.

DETAILED CONTENTS

UNIT I

1. Introduction

1.1 Introduction to post harvest technology of agricultural produce, its need, scope and importance

1.2 Brief description and introduction to various post harvest operation such as cleaning, grading, sorting, drying, storage, milling, size reduction, expelling, extraction, blending, heat treatment, separation, material handling (transportation, conveying, elevating), washing; their functions and use in the post harvest processing

UNIT II

2. Engineering Properties of Agricultural Materials

Introduction to the engineering properties of agricultural materials affecting post harvest operations. Physical properties such as shape, size, density and specific gravity. Aero and hydrodynamic properties such as drag coefficient and terminal velocity. Frictional properties e.g.

static friction, kinetic friction, rolling resistance, elasticity and angle of repose. Mechanical properties such as hardness, compressive strength, impact and shear resistance and thermal properties like specific heat, thermal conductivity and thermal diffusivity

UNIT III

3. Drying of Cereals and Pulses

3.1. Introduction, importance of drying, principles of drying and factors affecting drying, types of drying methods i.e. sun drying & artificial drying by mechanical means. Moisture content representation, equilibrium moisture content, determination of moisture content by direct and indirect methods.

3.2. Introduction to various grain drying systems - solar drying system, batch drying system, continuous flow drying system.

3.3. Principles of operation of different types of dryers viz. Deep bed dryers, thin layer dryers, continuous flow dryers, L.S.U. dryers, fluidized bed dryers, rotary dryer, tray and tunnel dryers.

UNIT IV

4. Storage of Cereals and Pulses

4.1. Introduction, need and importance, general principles of storage, temperature and moisture changes during storage i.e. influence of moisture content, relative humidity and temperature etc. on stored product.

4.2. Insect and other organism associated with stored grains.

4.3. Familiarization with the traditional and modern storage structures (Deep and shallow bins). Management of storage structures. Comparison of bag and bulk storage. Losses during storage and their control, space requirement of bag storage structure.

UNIT V

5. Post Harvest Technology of Fruits and Vegetables

5.1 Post harvest losses and introduction to factors affecting storage of fruits and vegetables. Need and importance of storage. Principle of storage of fruits and vegetables i.e. cold storage, controlled and modified atmosphere storage.
Introduction to packaging of fruits and vegetables and types of packaging.

5.2 Post harvest treatment to increase shelf life i.e. freezing, chilling and canning. Introduction to cool-chain for handling, storage and marketing of fresh fruits and vegetables.

INSTRUCTIONAL STRAGEGY

Arrange visits to storage and drying facility. Invited guest lecture may be arranged from technical persons of FCI/State Warehousing Corporation. This subject contains five units of equal weight age.

PRACTICAL EXERCISE

1. Determination of physical properties of agricultural materials e.g. size, shape, density and angle of repose.
2. Determination of moisture content of grains by direct/oven method and by moisture meter.
3. Study of different types of dryers.
4. Study of domestic grain storage structures.
5. Visit to warehouses (bag storage and bulk storage structures).
6. Visit to cold-storage.
7. Study of different packaging materials.
8. Demonstration of material conveying equipment.
9. Visit to canning industry (Milk Plant etc.)

RECOMMENDED BOOKS

1. Dr. K.M. Sahay & K.K Singh, “Unit operation of Agro Processing Engineering”, Vikas Publications, New Delhi.
2. A. Chakravarty , “Post Harvest Technology of Cereal, Pulses, Oil seeds” , Oxford & IBH Publication Co.
3. A. M. Michael & T.P. Ojha, Principles of Agriculture Engineering Vol-I ”, Jain Brothers, New Delhi.
4. Thompson , “Post Harvest Technology of fruits & Vegetables” , CBS Publishers and Distributors, Delhi.
5. Wills R.B.H. et al , “Post Harvest (Introduction Physiology Handling fruits & Vegetables”, Oxford & IBH Publication Co.

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 different streams.

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. Computer 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.

NOTE

The students enrolled under NCC will compulsorily undertake NCC as an open elective subject.

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

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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", (4th 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", (2nd 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 AGRO PROCESS ENGINEERING

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RATIONALE

The agricultural material has to undergo different operations and processes before reaching the consumer as a final product. In this subject, processing techniques of different agricultural products e.g. paddy, wheat, oilseeds, pulses have been covered. These will enable the students to understand the basic principles, operation and maintenance of different processing machinery and also to set up their own processing unit.

COURSE OUTCOMES

At the end of this course, students should be able to:
C01 : Explain the steps in processing of seeds of cereals, pulses and cotton.
C02 : Explain the rice milling process.
C03 : Describe various pulse milling methods.
C04: Explain steps involved in wheat milling.
C05: Explain principle of operation of various devices used in oil milling.
C06: Understand the operation of machines used in animal feed plant.

DETAILED CONTENTS

UNIT I

1. Seed Processing

Introduction, principles of seed processing. Steps in processing and flow diagram showing various steps/operations in processing. Machine used in processing of seeds of cereals, pulses and cotton e.g. conveyors and elevators, different types of cleaners and graders viz. air screen cleaner-cum-grader, disc separators, indented cylinders, spiral separators, specific gravity separators, pneumatic separators, magnetic separator, inclined draper and belt type electrostatic separators. Process of mechanical and acid delinting of cotton seeds. Layout and plan of seed processing plant. Seed treaters, calibration of seed treater.

UNIT II

2. Rice Milling

2.1. Paddy grain structure, paddy cleaning, pre milling treatment. Parboiling; basic concept and principles. Method of parboiling ; traditional method , single boiling , double boiling method

2.2. Modern methods:- CFTRI , Kisan continuous, pressure parboiling, RPEC and sodium chromate method.

2.3. Rice milling process: Deshelling operations of paddy. Under runner disc sheller, rubber roller sheller and hullers, whitening, polishing and grading.

2.4. Construction and operation of rubber roll sheller, vertical cone rice whitener, horizontal rice whitener. Methods to minimize the breakage of rice. Utilization of the by-products of rice mill. Different parameters to minimize the breakage of rice.

UNIT III

3. Pulse Milling

Important unit operations of pulse milling: cleaning, conditioning, polishing and grading. Pulse milling process: domestic level process, commercial level process.

Pulse milling method: Wet milling and dry milling. Factors affecting pulse milling out turn a). grain parameter b) machine parameter.

4. Wheat Milling

Introduction to flour milling, steps in wheat milling, receiving, drying and storage, cleaning, conditioning, milling into flour and by product, packaging and blending. Component, operation and performance of wheat mill.

UNIT IV

5. Oil Mills

Processes of oil milling, unit operations in oil mills. Oil expression and extraction. Mechanical expression devices such as Ghani, hydraulic press and screw press; Their principle of operations. Principle and concepts of solvent extraction and its types (Batch & Continuous)

UNIT V

6. Animal Feed Processing

Introduction to various animal feeds and sources of raw material. Processes of grinding, blending, mixing, pelleting of feed ingredients in Animal feed plant and Machines/ Equipment used for these processes. Densification of wheat straw and its advantages. Lay out of animal feed plant.

PRACTICAL EXERCISE

1. Demonstration of different materials handling equipment in seed processing plant.
2. Study of operation and adjustments of air screen cleaner-cum-grader.
3. Study of operation and adjustment of specific gravity separator.
4. Study of operation and adjustment of indented cylinder.
5. Visit to a seed processing plant.
6. Visit to rice milling industry for the study of parboiling and rice milling equipment.
7. Visit to a Dal mill and study the operations.
8. Visit to flour mill and study of machinery and processes used in flour milling.
9. Visit to animal feed plant and study of machines used in feed mill

INSTRUCTIONAL STRAGEGY

Visits to be arranged to various grain milling plants. Video clips of various processing units in operation to be used as teaching aid. This subject contains five units of equal weight age.

RECOMMENDED BOOKS

1. Dr. K.M. Sahay, and K.K Singh, "Unit operation of Agro Processing Engineering", Vikas Publications, New Delhi.
2. A. Chakravarty, "Post Harvest Technology of Cereal, Pulses, Oil seeds", Oxford & IBH Publication Co.
3. A. M. Michael & T.P. Ojha, Principles of Agriculture Engineering Vol-I ", Jain Brothers , New Delhi
4. Dr.K.M. Sahay, "Principle of Agro Process Engineering", Vikas Publications, New Delhi.
5. S. Bandyopadhyay & N.C. Roy, "Rice Processing Technology", Oxford & IBH Publication Co.
5. Bhatti Suman, "Fruits & Vegetable Processing", Oxford & IBH Publication Co.
6. Brooker D.B, "Drying & Storage of Grains & oil Seeds", Oxford & IBH Publication Co.
7. Holdman, "Food Process Engineering", Oxford & IBH Publication Co.

4.3 MANUFACTURING TECHNOLOGY

L	P
4	4

RATIONALE

The knowledge of manufacturing techniques in the area of foundry, machine shop (fitting shop, lathe machines and shaping), inspection and gauging and in coating both on metallic and non-metallic is essential at the first stage for understanding technology. Knowledge in various machining operations viz. lathe, drilling, boring, milling, and grinding processes, finishing operations and welding processes is very essential for the diploma holders.

COURSE OUTCOMES

After undergoing the subject, students will be able to:

CO1 Use various measuring instruments and gauges.

CO2 Explain the working principle of metallic coating and finishing processes.

CO3: Explain the process of pattern making, moulding and casting

C04: Explain the working of various machining processes such as lathe, drilling, boring, grinding and milling.

CO5: Carry out welding of jobs.

DETAILED CONTENTS

UNIT I

1. Fitting , Inspection Instruments and Gauges

Fits, limits and tolerances and their applications, unilateral and bilateral tolerances, gauges, gauge tolerances, micrometer, Vernier caliper, height gauge, surface plate, depth gauge, thread gauge, radius gauge, Go and Not-Go gauges.

2. Metallic and Non-metallic Coatings

Necessity of metallic and non-metallic coatings, principles and processes of electroplating, galvanizing, vacuumizing. Metal spraying, its methods- Wire gun and powder metal with their advantages.

UNIT II

3. Foundry

Introduction, types of patterns, pattern materials, cores and core boxes, core materials, preservation and storage of patterns. Introduction to moulding, types of moulding sands, types of moulds. Defects in moulds and their remedies. Casting defects and their remedies.

UNIT III

4. Lathe

Introduction, working principle of Lathe, Principle parts of lathe, types of lathe machines (name only), work holding devices. Cutting speed, feed and depth of cut.

Lathe operations – plain turning, facing, centring, parting off, undercutting, taper turning, eccentric turning, drilling, reaming, thread cutting and knurling.

Introduction to capstan and turret lathes. Difference between capstan and turret lathes.

Coolants and lubricants used in lathe.

5. Drilling

Introduction, Working principle of drilling machine, types of drilling machines i.e. portable, bench type and radial. Cutting parameters in drilling- cutting speeds, feed and depth of cut. Types of drills.

UNIT IV

6. Boring, Milling and Grinding

- Boring - Introduction and principle of boring, types of boring machines – horizontal and vertical. Cutting speeds, feed and depth of cut. Coolants and lubricants used.

- Milling – Working principle, Types of milling machines (Names only), types of milling cutters. Safety measures in milling.
- Grinding – Purpose of grinding, Methods of grinding- Surface, cylindrical and centreless, types of grinding wheels- Built up wheels, Mounted wheel and diamond wheel, balancing of grinding wheels. Safety precautions in grinding.

UNIT V

7. Finishing Operations

Lapping, honing operations and their applications, types of abrasives used and their selection.

8. Welding

Introduction to different types of welding- gas welding its process and advantage, arc welding- its principle and selection of electrodes, Resistance welding- spot, seam welding. Welding defects and their remedies.

NOTE:

a) Teachers will introduce various tools with their specific function to be used in various manufacturing processes

b) Teachers will acquaint the students with safety measures to be taken while using manufacturing processes and tools.

INSTRUCTIONAL STRATEGY

The teacher must show the models, tools and gauges as instructional materials for the effective teaching- learning process. This subject contains five units of equal weight age.

PRACTICAL EXERCISE

Fitting shop
Job No. 1: Practice on Male-female fitting.
Job No. 2: Drilling Practice.
Job No. 3: Internal threading practice.

Pattern shop
Job No.1: To prepare pattern of rectangular block, 'V' block, step pulley with core box, split pattern
Job No.2: Preparation of open floor mould of solid pattern, cope drag mould using split pattern

Foundry shop
Job No.1: To prepare casting of rectangular block, 'V' block.
Job No.2 : To prepare casting of step pulley with core box.

Turning shop
Job No.1: Practice on Simple, Step turning and facing.
Job No.2 : Practice of Drilling and Boring.

Job No.3 : Practice of Internal threading.
Job No.4 : Sharpen a single point cutting tool.

Machine shop
Job No.1: To prepare a spur gear on milling machine.
Job No.2 : Practice of Slot and Key way cutting
Job No.3 : Finishing of a job on grinding machine.

Welding shop
Job No.1: To prepare a job on gas welding machine.
Job No.2 : To prepare a job on arc welding machine.
Job No.3 : To prepare a job on spot welding machine.

RECOMMENDED BOOKS

1. BS Raghuwanshi, "Workshop Technology", Dhanpat Rai & Sons, Delhi.
2. SK Choudhary & Hazara, "Elements of Workshop Technology", Asia Publishing House.
3. Jain, "Principles of Foundry Technology", Tata McGraw Hill, New Delhi.
4. Chapman, "Workshop Technology, Vol-I, II & III", Standard Publishers Distributors, New Delhi.
5. RK Singhal, SK Kataria & Sons, "Workshop Practice", New Delhi.
6. Raj Kumar Chauhan, Jai Singh, Rajesh Kumar Madia, "Manufacturing Technology", North Publications.

4.4 SOIL AND WATER CONSERVATION

L	P
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RATIONALE

A diploma holder in Agriculture Engineering needs to learn about the soil erosion, the factors affecting the erosion besides the soil erosion control practices and drainage. A course on soil conservation shall equip the students with the knowledge of the properties of soil, agents of erosion, methods of erosion control, water harvesting and drainage problems. Hence this subject.

LEARNING OUTCOMES

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

C01: Understand properties of soil in relation to plant growth.
C02: Explain the mechanism of soil erosion due to water and wind.
C03: Take various measures for erosion control.
C04: Explain various methods of water harvesting.
C05: Reclaim salt affected soils.
C06: Explain causes of water logging and methods of drainage.

DETAILED CONTENTS

UNIT I

1. Soil and its Properties

Introduction to the soil as a natural body, definitions and functions of soil. Various constituents of soil and their importance. Soil as a medium of plant growth.

2. Properties of Soil in relation to Plant Growth

21 Soil separates and classifications (I. S. S. S. & U. S. D. A.). Soil texture and classification of soil (U. S. D. A.).

22 Soil structure; definition, types and factors affecting soil structure. Bulk density and particle density of soils. Soil consistency. Porosity & void ratio. Degree of saturation.

23 Soil moisture content (dry basis & wet basis). Method of soil moisture determination viz. gravimetric method. Retention of soil moisture; maximum retentive capacity, field

capacity, permanent wilting percentage, hygroscopic coefficient. Soil moistureclassification. Available water holding capacity of soil. Soil permeability, Coefficient ofpermeability.

UNIT II

3. Soil Erosion

3.1 Introduction, Classification of erosion viz. Geological and accelerated.

3.2 Mechanics of Water Erosion: Raindrop erosion, Sheet erosion, Rill erosion, Gully erosion and principle of gully erosion and Classification of gullies. Stream channel erosion. Effects of water erosion, Factors affecting erosion by water.

3.3 Mechanics of Wind Erosion: Processes of saltation, suspension, surface creep. Factors affecting erosion by wind.

UNIT III

4. Erosion Control Measures

4.1. Principles of erosion control

4.2. Agronomical measures: Agronomic and field practices to control erosion by wind and water i.e. Contour farming, strip cropping, tillage and vegetated water ways for the control of erosion.

4.3. Mechanical measures: Terracing to control erosion by water. Types of terraces. Terrace design parameters and planning a terrace system. Bench terraces, types and design parameters.

4.4. Permanent soil conservation structures viz. Drop spillway, Chute spillway, Drop inlet spillway for the control of erosion; their principles, adaptability, soil conservation through tree and grass cultivation, ground water recharge, watershed management.

UNIT IV

5. Water Harvesting and Storage

Need, Importance and scope of water harvesting, Types and Methods of water harvesting. Brief description of the different systems of water harvesting and storage.

6. Salt affected soils and their reclamation

6.1 Saline, alkaline and acid soils, Reasons and factors of their formation.

6.2 Chemical Properties: Soil reaction (pH), Electrical Conductivity (EC), Cation Exchange Capacity (CEC), Sodium Adsorption Ratio (SAR), Exchangeable Sodium Percentage (ESP), salt concentration in the soils. Effect of salinity, alkalinity and acidity on plant growth. Reclamation of these soils and their management.

UNIT V

7. Waterlogged soils and their drainage

7.1 Water logging, causes of water logging and its effects. Drainage. Types of drainage systems viz. surface and subsurface drainage.

7.2 Surface drainage- types of surface drains (random drain, parallel field drain, parallel open ditch and bedding system in flat areas).

7.3 Subsurface drainage- types of subsurface drains (tile drains, mole drains, drainage wells, deep open drains). Introduction to investigation for subsurface drainage.

8 Environment Issues

Waterlogged soils are health hazard, salt affected soils create impermeability and long term effects.

INSTRUCTIONAL STRAGEGY

Works on soil conservation project of state government need to be shown for practical exposure such as Sub surface drainage of CSSRI, Karnal. Water harvesting ponds/structures in the field/university may be visited for field exposure. This subject contains five units of equal weight age.

RECOMMENDED BOOKS

1. Suresh R , “Soil & Water Conservation Engineering” , Standard Publication, New Delhi
2. A.M. Michael & T.P. Ojha, “Principle of Agricultural Engineering Volume-II”, Jain brothers, New Delhi
3. V.V.N Murthy, “ Land and Water Management Engineeing” , Kalyani Publishers, New Delhi
4. Gurmail Singh, “Manual of Soil & Water Conservation Practice”, Oxford & IBH Publication co.

4.5 COMPUTER AIDED DESIGN IN AGRICULTURE ENGINEERING

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RATIONALE

A diploma holder is expected to prepare and interpret CAD Drawings. Hence this subject.

COURSE OUTCOMES

On completion of this course, students will be able to:

CO1: Handle CAD software by using different commands.

CO2: Prepare drawings of various mechanical components using Auto CAD.

C03 : Use commands for dimensioning and hatching.

CO4: Practice on 3 D modelling.

DETAILED CONTENTS

1. Introduction to Computer Aided Design (2D) commands of Auto CAD software.

   1.1 Concept of AutoCAD, Starting up, Tool bars in Auto CAD software, understanding user interface.

   1.2 Practice on – how to create a new drawing file, setting drawing limits & units, saving a file.

   1.3 Practice on Function keys, Ortho, Osnap, Grids, Snap settings, zoom, PAN.

   1.4 Draw line in different ways using absolute co-ordinate, relative co-ordinate and angular co-ordinate system, WCS, UCS.

2. Practice on Draw commands such as arc, circle, ellipse, ray, polyline, construction line, splines, Rectangle, Polygon, Donut, Fill, Table.

3. Practice on Edit commands such as erase, copy, move, mirror, array, offset, rotate, oops, undo, redo, scale, stretch, trim, break, extend, chamfer, fillet, O snap command, Pedit, Lengthen, Explode, Create & insert Block.

4. Practice on Text commands: Dtext, Mtext, editing text, text size, text styles, change properties.

5. Practice on Layer Commands: creating layer, freeze, layer on/off colour assigning, current layer, lock & unlock layer, move from one layer to other.

6. Practice on Hatching, Hatch pattern selection, Gradient.

7. Practice on Dimensioning, linear dimensioning, angular dimensioning radius/ diameter dimensioning, aligned dimensioning, dimension style.

8. Practice on properties Tool bar- Colour, Width, Line type.

9. Practice on print/plot commands. Export/import commands.

10. Practice on making complete drawings of components by doing following exercises:

- Wall Bracket
- Stepped pulley,
- Flanged coupling
- Screw jack
-

11. 3 D Modelling –Extrude, Revolve, Subtract, Union, Interference, Mirror, Intersect, Rotate, Align, Shell, View ports.

12. Practice of Visual style, view, 3 D orbit.

13. Practice on Solid Editing- Face & Edge.

14. Practice on 3D models
    - Cone
    - Cylinder

15. Introduction to Other Softwares:
    Pro- Engineer/CATIA/Inventor/ Unigaphics/Solid Work.

INSTRUCTIONAL STRATEGY

Teachers should show model or realia of the component/part whose drawing is to be made. Emphasis should be given on dimensioning, & layout of sheet. Teachers should ensure use of IS codes related to drawing.

RECOMMENDED BOOKS

1. T. Jeyapooran, "Engineering Drawing with AutoCAD 2000", Vikas Publishing House, Delhi.
2. S. Vishal, " Auto CAD", Dhanpat Rai Publishing Company, New Delhi.
3. P. Nageswara Rao, "AutoCAD for Engineering Drawing Made Easy", Tata McGraw Hill, New Delhi.
4. Ajit Singh, "Auto CAD 2000", TMH, New Delhi.
5. Instruction Manual of the software used (AutoCAD, ProE, Solidwors, Unigraphic etc.)

4.1.1 GREEN HOUSE TECHNOLOGY

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RATIONALE

In view of day- by day increasing population and decrease in cultivated land, it is very important to enhance the agricultural production. In this context, it is important to apply advance technology like greenhouse for getting more from same piece of land. Hence this subject.

COURSE OUTCOMES

After undergoing this course, the students will be able to:
CO1: Classify green houses based on shape, utility, construction and covering material.
CO2: Describe features, components and design criteria of green house
C03: List factors that affect greenhouse environment.
C04: Describe working of advance irrigation systems in greenhouse.
C05: Comprehend importance of repair and maintenance of green houses.

DETAILED CONTENTS

UNIT I

1. Introduction

Concept of Green-house technology. History and development of greenhouse, Scope of greenhouse technology. Functions of Green-house. Green-house effect, Mechanism of greenhouse effect.

UNIT II

2. Types of Green houses

Greenhouse Type Based On Shape: Lean to type greenhouse, Even span type greenhouse, Uneven span type greenhouse, Ridge and furrow type, Saw tooth type, Quonset greenhouse.

Greenhouse Type Based on Utility: Greenhouses for active heating, Greenhouses for active cooling.

Greenhouse Type Based on Construction: Wooden framed structure, Pipe framed structure, Truss framed structure.

Greenhouse Type Based on Covering Material: Glass greenhouses, Plastic film greenhouses,

Rigid panel greenhouses.

UNIT III

3. Features, components and design criteria of green house

Greenhouse Features (Frame, Covering, Flooring and Ventilation, Heating and Automated Watering System).

Site selection of greenhouse. Various components of greenhouse/ Poly-house. Criteria for design and construction of plastic film greenhouse.

UNIT IV

4. Introduction to Environmental factors

Introduction to Environmental factors in greenhouse environment viz., Light, temperature, Relative humidity, carbon dioxide, greenhouse gases and ventilation.

5. Systems in Greenhouse

Greenhouse irrigation, rules of watering, hand watering, perimeter watering, overhead sprinklers, boom watering, drip irrigation, advanced protected agricultural systems such as plastic mulches, row cover, liquid hydroponics and aggregate hydroponics.

UNIT V

6. Repair and Maintenance of Greenhouse

Ventilation system, evaporative cooling system, heating systems, greenhouse sanitation, utility repairs, structural repairs and shade cloth maintenance.

INSTRUCTIONAL STRAGEGY

Visits to be arranged to green houses. Video clips of green houses to be used as teaching aid. This subject contains five units of equal weight age.

RECOMMENDED BOOKS

1. K. Radha Manohar, and C. Igathinathane, “Greenhouse Technology and Management”, B.S. Publications, Hyderabad.
2. Vilas M. Salokhe and Ajay K. Sharma, “Greenhouse Technology and Applications”, Agrotech publishing, Udaipur.
3. G. N. Tiwari, “Greenhouse Technology for Controlled Environment”, Narosa Publishing House, New Delhi.

4. Protected cultivation of high value vegetables and cut flowers – A value chain approach, ICAR, New Delhi, NAIP.

5. Kumar, S., Saravaiya, S. N., and Pandey, A. K., "Precision Farming and Protected Cultivation: Concepts and Applications" CRC Press, Delhi.

WEB RESOURCES

1 https://nhb.gov.in/pdf/Technical_Standard.pdf

2 https://www.jains.com/

4.1.2 SOLAR TECHNOLOGY

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RATIONALE

The concepts of utilization of solar energy with theoretical background will be taught to effectively utilize the energy for agricultural operations and agricultural processing activities

COURSE OUTCOMES

After undergoing this course, the students will be able to:
CO1: Explain the working principle of solar cell.
CO2: Explain the working of various solar collectors.
CO3: Describe the methods to store the solar energy.
C04: Explain the working principle of various solar energy based appliances.

DETAIL CONTENTS

UNIT I

1 Solar Energy Technology

1.1 Introduction, Significance of solar energy, solar spectral.

1.2 Introduction to Solar Radiation (Beam and Diffuse solar radiation), Solar Constant, Measurement of Solar Radiation - Pyrheliometer, Pyranometer, Sunshine Recorder.

UNIT II

2 Solar Energy Conversion

2.1 Principle of conversion of solar radiation into heat

2.2 Photo voltaic cell – Working principle, Applications, Advantages and limitations, current voltage characteristics of a solar cell.

2.3 Solar Electric Power Generation – Solar photovoltaic, Solar water pumping system, Solar lantern, Solar street light, Solar fencing.

UNIT III

3 Solar Energy Collectors

3.1 Principles of thermal collection and storage.
Solar Collectors and its types (concentrating types and non-concentrating types) Comparison of concentrating types and non- concentrating types

3.2 Solar collectors – Non concentrating types – Solar liquid flat plate collector – Solar air flat plate collector.

3.3 Concentrating collectors – Focusing type (Line focusing collectors and Point focusing collectors).
Flat plate collector with adjustable mirrors – Advantages and limitations of concentrating collectors.

3.4 Introduction to SPV module, its principle and applications.

UNIT IV

4 Solar Energy Storage

4.1 Introduction to Solar energy storage.

4.2 Methods of storing solar energy - Thermal energy storage (Sensible heat storage and Latent heat storage), Electrical storage (battery storage), Chemical & Thermo-chemical energy storage.

4.3 Solar Pond – Working principle and description of solar pond, application of solar pond.

UNIT V

5 Solar Energy applications

5.1 Solar Water Heater – Natural Circulation type and Forced Circulation type.

5.2 Solar Furnace – Working Principle, Advantages & Limitations

5.3 Solar Cooker – Working Principle of Box Type Cooker, its Advantages & Limitations

5.4 Solar Water Pumping –Working Principle

5.5 Solar Distillation–Working Principle

5.6 Solar Crop Dryer–Working Principle

INSTRUCTIONAL STRAGEGY

Visits to be arranged to show solar cells, solar collectors and solar appliances. Video clips of solar collectors to be used as teaching aid. This subject contains five units of equal weight age.

RECOMMENDED BOOKS

1. Pakirappa, and V. Naresh, “Energy sources and power plant Engineering”, Radiant Publishing House, Hyderabad.
2. S. Rao, “Renewable & Conventional Energy”.
3. G.D Rai, “Solar Energy Utilization”, Khanna Publishers, New Delhi.
4. SP Sukhatme, “Solar Energy”, Tata McGraw Hill Publishing CO. Ltd., New Delhi.
5. G.D Rai, “Non-Conventional Energy Sources”, Khanna Publishers, New Delhi.

THIRD YEAR

NSQF LEVEL - 5

18. 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	Tot	Th	Pr	Tot	
5.1	Industrial Training-II	-	2	0+1=1	-	40	40	-	60	60	100
5.2	Farm Machinery and Implements - II	4	4	4+2=6	40	40	80	60	60	120	200
5.3	Farm Tractor	4	4	4+2=6	40	40	80	60	60	120	200
5.4	*Entrepreneurship Development and Management	3	-	3+0=3	40	-	40	60	-	60	100
5.5	Precision Agriculture	3	-	3+0=3	-	40	40	-	60	60	100
5.6	Multidisciplinary Elective (MOOCs/offline)	2	-	2+0=2	40	-	40	60	-	60	100
5.7	Renewable Energy Sources in Agriculture Engineering	3	2	3+1=4	40	40	80	60	60	120	200
# Student Centered Activities(SCA)		-	4	-	-	-	-	-	-	-	-
	Total	**19**	**16**	**25**	200	200	400	300	300	600	1000

* Common with other Diploma Courses

\# Student Centered Activities will comprise of co-curricular activities like extension lectures on Constitution of India, Electoral Literacy, Motor Vehicles (Driving) Regulations 2017 etc., games, 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	Tot	Th	Pr	Tot	
6.1	Project Oriented Professional Training	-	35	**0+16=16**	-	200	200	-	300	300	500
	Total	-	**35**	**16**	**-**	**200**	**200**	**-**	**300**	**300**	**500**

19. HORIZONTAL AND VERTICAL SUBJECTS ORGANISATION

Sr. No.	Subjects/Areas	Hours Per Week	
		Fifth Semester	Sixth Semester
1.	Industrial Training-II	2	-
2.	Farm Machinery and Implements - II	8	-
3.	Farm Tractor	8	-
4.	Entrepreneurship Development & Management	3	-
5.	Precision Agriculture	3	-
6.	Multidisciplinary Elective (MOOCs/offline)	2	-
7.	Renewable Energy Sources in Agriculture Engineering	5	-
8.	Project Oriented Professional Training	-	35
9.	#Student Centered Activities(SCA)	4	-
	Total	**35**	**35**

20. COMPETENCY PROFILE AND EMPLOYMENT OPPORTUNITIES

Government and private sectors related to **Agriculture Engineering** require **supervisors and technician engineers,** having well developed skills with clear choice of procedures. They are expected to have complete knowledge and practical skills related to agriculture engineering. They shall be able to communicate clearly with others. Diploma holders after passing 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.

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.

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.

They are expected have the knowledge of Farm Machinery and Implements, Farm Tractor Precision Agriculture Renewable Energy Sources in Agriculture Engineering and practices being followed in the agriculture engineering. They might find work with a manufacturing company and spend time maintaining, or even designing, the machines that perform much of the automations. They might also work in relevant laboratories for any institute, university or even a private companies. They are expected to have good exposure of humanities, life skills, entrepreneur development and management to establish small start-ups in the area of Marketing, Sales, Repair and Maintenance etc**.**

They have wide scope to work as supervisory technical employee on wage basis in following organizations:

In manufacturing industries primarily in private sector and to some extent in public sector such as Agriculture Machinery Manufacturing, Processing Agro Industry and Agriculture Implements Manufacturing, Department of Agriculture, Minor Irrigation and Tube well Organization, Command area Development, Soil and Water Conservation Department, Organization dealing with Renewable Sources of Energy Agro-Industries Corporation, Land Development Corporation, Seed Corporation and State Farms, Animal Feed Plant and Fertiliser Plant of Fertiliser Corporation of State, Ware Housing Corporations, Rice Mill, Seed Processing Plants, Flour Mills, Pulse Mill (Dal), Research and Extension Department of Agriculture, Organizations Manufacturing Agro Implements and Tractors, Instructor in Teaching Institutes, Irrigation Equipment Agro Implements and Tractors, Environmental Conservation Department, In Railways, Hospitals, Military Engineering Services, Boards and Corporations, Construction Companies, Transportation Departments, Telecommunication, PWD and Rural Development Agencies.

They have wide scope in establishing small start-ups in the area of Marketing and Sales, Manufacturing Units and Repair and Maintenance units etc.

21. PROGRAMME OUTCOMES

The programme 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 Agriculture Engineering

PO3: Demonstrate cognitive and practical skills to complete tasks and 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 PROGRAM 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.	• Explain the working environment of industries. • Describe present and future requirement of industries. • Explain different controls and gauges on tractors. • 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.
PO2: Acquire knowledge of facts, principles and processes related to agriculture engineering.	• Develop competencies and skills required by relevant industries. • Explain different Inter-culture Tools and Fertilizer Application Equipment Explain the working of Laser Land Leveler. • Describe the working of different systems on tractor like power transmission system**,** brake system, hydraulic system and steering system etc. • Explain the different components of electrical system. • Explain the principles of management including its functions in an organisation. • Describe the concepts of GIS and GPS. • Explain the concept of VRT and VRA in precision agriculture. • Recognize operation of sensors. • Describe the application and challenges of precision agriculture. • Explain various renewable and non-renewable sources of energy. • Describe the detailed concepts of power generation with the wind energy.

	• Describe the prospects of Tidal energy and geothermal energy.
PO3: Demonstrate cognitive and practical skills to complete tasks and solve problems.	• Take necessary safety precautions and measures. • Execute works on different types of Sprayers and Dusters • Work on Mower, Reaper and Digger. • Work on Thresher, Combine and Machinery for paddy straw management. • Prepare an estimation of Farm Machinery job. • Analyse cost of periodical maintenance and repair of tractors. • Apply critical thinking problem solving. • Display analytical and research abilities. • Operate and work on various types of Biomass energy systems. • Apply solar and other renewable sources of energy in context with agriculture engineering • Develop the problem-solving skills in finding solutions to the problems in the world of work. • Demonstrate the competence to apply knowledge and skills learnt earlier in the context of the project.
PO4: Develop skills to collect, organize and communicate information.	• Develop writing, speaking and presentations skills. • Conduct market survey and prepare project report. • Explain benefits and limitations of precision agriculture. • Define the problem statement of the Industrial training as per industry need. • Apply the communication skills in writing and presenting the technical report.
PO5: Accomplish own work and supervise others work.	• Work in team for solving industrial problems. • Acquire interpersonal skills and work as a team member.

PO6: Select online open elective of own interest to promote self-learning.	• Demonstrate self and time management. • Integrate multiple knowledge domains. • Enhance the scope and depth of learning.

23. SUBJECTS & CONTENTS

(THIRD YEAR)

FIFTH SEMESTER

5.1 INDUSTRIAL TRAINING II

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RATIONALE

Industrial training will help the students to understand the working environmentof relevant industries. The student will learn to work in team to solve the industrial problems. It willalso give exposure about the present and future requirements of the relevant industries. This trainingis 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: Explain the working environment of industries
CO2: Take necessary safety precautions and measures.
CO3: Describe present and future requirement of industries.
CO4: Work in team for solving industrial problems
CO5: Demonstrate competencies and skills required by relevant industries.
CO6: Demonstrate 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 Headof 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 FARM MACHINERY & IMPLEMENTS-II

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RATIONALE

The students of diploma in agriculture engineering must understand the relevant knowledge and skills of basic principles, construction and working of farm machinery for different crops. This will also enable them to select appropriate machinery and execute repair and maintain the same. These knowledge and skills will be useful in running an enterprise related with farm machinery and help them get appropriate employment in farm mechanization sectors.

COURSE OUTCOMES

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

CO1: Explain different Inter-culture Tools and Fertilizer Application Equipment.
CO2: Execute works on different types of Sprayers and Dusters.
CO3: Work on Mower, Reaper and Digger.
CO4: Work on Thresher, Combine and Machinery for paddy straw management.
CO5: Explain the working of Laser Land Leveler.
CO6: Prepare an estimation of Farm Machinery job.

DETAILED CONTENTS

UNIT I

Inter-culture Tools and Weeding Tools
Functions, working and constructional details of Cultivators (Disc, Rotary & Tine), Wheel Hand Hoe, Paddy weeder, Power weeder/ Brush cutter

Fertilizer & Manure Application Equipments
Introduction to working of different types of machines (granular fertilizer spreaders, liquid fertilizer applicator & Manure spreader) used for application of fertilizers & manures for different crops.

UNIT II

Plant Protection Machinery & Equipments

- Introduction to different types of machines used for application of insecticides & pesticides such as sprayers, dusters, foggers etc.
- Sprayers-Different types of sprayers viz. hand sprayers/knapsack sprayer, foot sprayer, power sprayers and tractor operated sprayers. Types of spray: low, medium and high pressure.
- Operation, working, functions and components of Power & Hydraulic Spraying systems
- Types of nozzles used on sprayers. Care & maintenance of sprayer
- Dusters- Functions of a duster, different types of dusters (Plunger, Knapsack, Rotary & Power operated), Care & maintenance of dusters
- Precautions for safe use of Insecticides and Pesticides.

UNIT III

Harvesting Machinery and Horticultural tools

- Methods of harvesting, Introduction to various machines used for harvesting different crops (mowers, reapers, diggers, pickers, pluckers).
- Mower - Different types of mowers, Constructional details and working principle of mower, Alignment & Registration of mower.
- Reaper - Different types of reapers (Animal Drawn and Vertical Conveyor) and their working principle.
- Diggers - Different types of diggers, Constructional details and working principle of Potato digger elevator and groundnut digger shaker.
- Introduction to various horticultural tools and machines such as Hedge Trimmers, Pruning shears & secateurs, Tree Pruners, Hedge shears, Loppers, Saws, Axes etc.

UNIT IV

Threshing Machinery

- Principle of threshing, Methods of threshing (Manual, Animal & Machine).
- Power thresher – Different types of power threshers, Constructional details and working principle of power thresher. Adjustments of a thresher.

- Paddy thresher - Constructional details and working principle of paddy thresher.
- Different terms related to threshing- Threshing efficiency, Cleaning efficiency, Concave clearance, Feed rate. Different types of losses during threshing and their management.
- Installation of Power thresher, Preventive maintenance and storage of thresher.
- Trouble shooting in power thresher. Safety precautions for using threshers.
- Combine Harvester – Functions of a combine harvester. Constructional details and working principle of a Combine harvester. Advantages & Disadvantages of Combine harvester.

Paddy Straw Management Machinery for in –situ and ex-situ

- Introduction to Happy seeder, Super seeder and Smart seeder.
- Introduction to straw reaper, straw combine and bailer.

UNIT V

Land Development Machinery

- Objectives & Benefits of land levelling.
- Laser Land Leveller - Constructional details and working principle of Laser Land Leveller

Selection, Cost Economics and Testing of Farm Machinery

- Selection of Farm Machinery.
- Cost estimation of using Farm Machinery
- 8Introduction to the testing of Farm Machinery, testing codes and organization dealing in testing and standardization of Farm Machinery in India.

PRACTICAL EXERCISES

1. Operation and constructional features of Cultivator.
2. Demonstration and constructional features of Power Sprayer.
3. Study of constructional features and working of Conveyor Reaper.
4. Demonstration and constructional features of Potato digger.
5. Study and use of Horticultural tools.
6. Study of constructional features and working of Power thresher
7. Study of constructional features and working of Laser Land Leveler.
8. Tractor driving practice.
9. Hitching and de-hitching of different implements with the tractor.

RECOMMENDED BOOKS

1. Dr. Jagdishwar Sahay , " Elements of Agricultural Engineering" , Standard Publisher Distributors, Nai Sarak, Delhi.
2. R.A.Kepner, Roy Bainer and E.H. Barger , " Principle of Farm Machinery" ,CBS Publishers and Distributors, Delhi.
3. A.M. Micael & T.P.Ojha, Principles of Agriculture Engineering Vol-I " , Jain Brothers , New Delhi
4. C.P.Nakra , " Farm Machines & Equipments" , Dhanpat Rai & Sons ,Nai Sarak New Delhi.
5. Dr. O.P. Singhal and Naresh Chandra Aggarwal, " Elements Of Agricultural Engineering Part 1 & 2" , Saroj Prakashan, Allahabad.
6. Smith, " Farm Machinery and Equipments" , Tata McGraw Hill Publishing Company Ltd., New Delhi.

RECOMMENDED WEBSITES

1. www.hau.ac.in
2. www.pau.edu
3. icar.org.in
4. krishi.icar.gov.in
5. ciae.icar.gov.in
6. aed.tn.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. Teaches should take the students to industry and explain the details of various systems and their components. While imparting instructions, focus should be on conceptual understanding. Training slides and videos should be used to supplement the classroom teaching. Drawings and manuals of various machines and equipment may be used to illustrate the constructional and operational details. Besides this, live demonstration of the machines, implements and equipment may be done by specific visits to the local manufacturing units, so that students are able to understand these more clearly.

5.3 FARM TRACTOR

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RATIONALE

Tractor is the most important machinery in a farm and the students of diploma in agriculture engineering should be well-familiar with the construction, working and operation of various tractors used for different purposes and their repair and maintenance, including overhauling. The course will equip the students to handle the tractors efficiently and effectively. This course will also help them to run tractor and machinery related to it.

COURSE OUTCOMES

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

CO1: Explain different controls and gauges on tractors.

CO2: Describe the working of different systems on tractor like power transmission system**,** brake system, hydraulic system and steering system etc.

CO3: Explain the different components of electrical system.

CO4: Analyse cost of periodical maintenance and repair of tractors.

DETAILED CONTENTS

UNIT-I

Introduction

Sources of farm power and scope of mechanization. Tractor – classification based on structural design and purpose. Main assemblies of the tractors (Names only). Familiarization with various controls and gauges on tractors and their functions.

Power Transmission System of Tractors

Functions and various components of power train. Clutch; functions of clutch, type of clutch (single plate, dual plate and multi plate clutch). Gear box; function and working of gear box, types of gear boxes (sliding, constant mesh and synchromesh gears). Differential and differential lock; function and constructional details. Final drive; reduction gear and rear axle. Power take off shaft and drive

to the PTO shaft.

UNIT-II

Braking System

Importance and function of brakes, various types of brakes viz. mechanical (internal expanding and external contracting type) and hydraulic and their working.

Wheels and Tyres of Tractors

Function of tyres. Causes of tyre wear. Need for changing the rear wheel, spacing of wheels and arrangement for the change. Wheel ballasting and methods of ballasting. Traction - Traction efficiency, coefficient of traction, rolling resistance, soil pressure, wheel slip, rim pull.

UNIT-III

Hydraulic System

Principles and working of hydraulic system. Various components and working of hydraulic system of tractor. Position control, draft control and mix control. Various components of hitching system of tractors viz. 3-point linkage, PTO, pulley and drawbar power.

Steering System of Tractors

Functions and components of steering systems. Types of steering gear boxes in different type of steering systems, power steering. Working of different types of steering systems. Familiarity with the concepts of toe-in, toe-out, camber angle, caster angle and king pin inclination.

UNIT-IV

Electrical System of Tractors

Components of electrical systems viz. battery, starter switch, self-starter, motor, dynamo: their construction, functions, operation; maintenance and care of the battery.

Periodical Maintenance, Repair and Overhauling of Tractor

Periodical maintenance, based on hours of operation.

Need-based repair of tractor.

UNIT-V

Selection, Safety, Cost Economics and Testing of Tractor

Various factors affecting the right selection of a tractor.

Safety measures in the operation of tractor.

Cost analysis of use of tractors.

Tractor testing stations, test conditions, general requirements for testing a tractor. Type of tests. BIS and

ISO standards.

PRACTICAL EXERCISES

1. Familiarization with different makes, models and availability of tractor, main units and control gauges.
2. Familiarization with various tools used for dismantling and assembling of tractors and implements
3. Pre-starting checks, correct operating techniques & energy saving tips for a tractor.
4. Operation and constructional details of clutch.
5. Study of constructional details of gear box and differential.
6. Operation and constructional features of brake (Hydraulic and mechanical).
7. Study of constructional features steering system of tractor
8. Operation of hydraulics system, draft position and mix control systems.
9. Periodical maintenance and service of tractors
10. Visits to tractor repair workshops/ service centres for the demonstration of repair work and overhaul of tractors and estimating cost of repairs.

RECOMMENDED BOOKS

1. Dr. Jagdishwar Sahay, "Elements of Agricultural Engineering" , Standard Publisher Distributors, Nai Sarak, Delhi.
2. R.A.Kepner, Roy Bainer and E.H. Barger, "Principle of Farm Machinery" ,CBS Publishers and Distributors, Delhi.
3. A.M. Michael & T.P.Ojha, Principles of Agriculture Engineering Vol-I " , Jain Brothers , New Delhi
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5. Dr. O.P. Singhal and Naresh Chandra Aggarwal, "Elements Of Agricultural Engineering Part 1 & 2", Saroj Prakashan, Allahabad.
6. Smith , " Farm Machinery and Equipments" , Tata McGraw Hill Publishing Company Ltd., New Delhi
7. S.C. Jain & C.R. Rai, " Farm Tractors Maintenance & repairs", Tata Mc Graw-hill Publishing Co. Ltd., New Delhi.

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1. www.hau.ac.in
2. www.pau.edu
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5. ciae.icar.gov.in
6. aed.tn.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. Teaches should take the students to industry and explain the details of various systems and their components. While imparting instructions, focus should be on conceptual understanding. Training slides and videos should be used to supplement the classroom teaching. Use of cut-sectional models of various systems, charts and video films should be made as instructional material for the best efficacy of teaching learning process.

5.4 ENTREPRENEURSHIP DEVELOPMENT AND MANAGEMENT

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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 directed towards 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

After undergoing the subject, the 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 by new 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 organizations 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 organized. This subject contains five units of equal weightage.

5.5 PRECISION AGRICULTURE

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RATIONALE

Agriculture engineering diploma student needs to understand basic principle of precision farming/agriculture and the latest technology used in crop production. They should also have mastery over the principles pertaining to optimum use of seed, soil, water and machinery for maximum agricultural yield, besides understanding engineering principles. After studying this subject, the students shall have adequate knowledge and skills pertaining to different aspects of precision farming.

COURSE OUTCOMES

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

CO1: Explain benefits and limitations of precision agriculture.
CO2: Describe the concepts of GIS and GPS.
CO3: Explain the concept of VRT and VRA in precision agriculture.
CO4: Recognize operation of sensors.
CO5: Describe the application and challenges of precision agriculture.

DETAILED CONTENTS

UNIT I

1. Precision agriculture

1.1 History of precision agriculture. Introduction to precision agriculture - need and functional requirements. Importance of precision agriculture.
1.2 4 R's for precision agriculture.
1.3 Benefits of Precision Agriculture (Agronomical perspective, Technical perspective Economic benefits, Environmental benefits).
1.4 Limitations of Precision Agriculture.
1.5 Status, Scope and Adoption of Precision Farming in India.

UNIT II

2. Tools and Equipment of precision agriculture

2.1 Geographic Information system (GIS)

Introduction to Geographic Information system (GIS) based precision agriculture. Principle, functions, components and applications of GIS.

2.2 Geographical Position System (GPS)

Introduction to Geographical Position System (GPS), Basics segments of GPS (Space Segment, Control Segment and Receiver/User Segment), Function and advantages of GPS.

UNIT III

3. IDI (Intelligent Devices and Implement) devices usage in Precision Agriculture

3.1 Introduction to soil mapping, crop scouting, precision maps, Types of Precision Maps (Soil Maps and Yield Maps).

3.2 Familiarization with Grid Sampling, Variable Rate Technology (VRT) & its benefits, Variable Rate Application (VRA), Types of VRA systems (Maps based and sensors based), Variable Rate Applications Technologies in Agriculture.

UNIT IV

4. Remote Sensing

4.1 Introduction to Remote sensing. Elements of remote sensing process**.** Types of Remote Sensing (names only). Types of Remote Sensing resolution (spatial resolution, spectral resolution, radiometric resolution, and temporal resolution).

4.2 Applications of remote sensing in precision agriculture.

4.3 Introduction to different types of sensor (Soil Temperature Sensor, Electromagnetic Sensor, Optoelectronic Sensor, Electrochemical Sensor, Ion Selective Electrode Sensor, Mechanical Sensors**,** Soil moisture sensor.

UNIT V

5. Applications of Precision Agriculture

5.1 Introduction to following:

VRT in Precision Agriculture, Yield Monitoring and Mapping in Precision Agriculture, Yield Prediction, Micro Irrigation: Sprinkler and Drip Irrigation, Site-Specific Crop Management (SSCM), Soil Mapping in Precision Agriculture, IOT in Precision Agriculture, Artificial Intelligence and Machine Learning.

5.2 Application of drones for crop monitoring and spraying. Challenges of Precision Agriculture

RECOMMENDED BOOKS

1. Henten, EJV, Goense, D and Lokhorst C, "Precision Agriculture". Wageningen Academic Publishers.

2. Sharma, P, Maji, MK, and Tiwari, KN., "Precision farming". Gene-Tech Books, New Delhi, Edition.
3. Ram T, Lohan SK, Singh R and Singh P., "Precision Farming: A New Approach". Astral International Pvt. Ltd., New Delhi.
4. Shannon DK, Clay DE and Kitchen NR, "Precision Agriculture Basics" American Society of Agronomy, Crop Science Society and Soil Science Society of America, Gulford Rd, Madison.
5. Singh AK and Chopra UK, "Geoinformatics Applications in Agriculture". New India Publishing Agency, Pritam Pura, New Delhi.

RECOMMENDED WEBSITES

1. www.hau.ac.in
2. www.pau.edu
3. icar.org.in
4. krishi.icar.gov.in
5. ciae.icar.gov.in
6. aed.tn.gov.in

INSTRUCTIONAL STRATEGY

This subject contains five units of equal weightage. Teaches should take the students to industry and explain the details of various systems and their components. While imparting instructions, focus should be on conceptual understanding. Training slides and videos should be used to supplement the classroom teaching. Teachers should invite experts from the industries, research and higher level organizations/institutions to engage some sessions on the latest developments taking place on the subject. Some industrial and field visit may also be arranged.

5.6 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 open elective, the students will be able to:
CO1: Apply critical thinking 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. Digital Image Processing
6. Introduction to Machine Learning
7. Fundamentals of Artificial Intelligence
8. The Joy of Computing Using Python
9. Cloud Computing
10. Introduction to Industry 4.0
11. Industrial Internet of Things
12. Object Oriented System Development using UML, Java and Patterns

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, Khan Academy 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 offlinemode. The assessment of offline multidisciplinary elective shall be internal and external. The offlinemultidisciplinary 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.

RECOMMENDED WEBSITES

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

5.7 RENEWABLE SOURCES OF ENERGY IN AGRICULTURE ENGINEERING

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RATIONALE

Since the conventional energy resources are under fast depletion, it is high time to tap the non-conventional energy sources. The Agricultural Diploma holder must be aware about the renewable energy resources like solar energy, Biomass energy, wind energy, geothermal energy, ocean energy, MHD, hydro energy which is used for number of applications such as power generation, heating, cooling etc. This subject aim is to develop the skill required for renewable energy resource, so that they help the society for fulfilling the energy demand which is increasing day by day.

COURSE OUTCOMES

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

CO1: Explain various renewable and non-renewable sources of energy.

CO2 Operate and work on various types of Biomass energy systems.

CO3: Describe the detailed concepts of power generation with the wind energy.

CO4: Describe the prospects of Tidal energy and geothermal energy.

CO5: Apply solar and other renewable sources of energy in context with agriculture engineering

DETAILED CONTENTS

UNIT I

1. **Introduction**

   Renewable and Non-Renewable sources of energy. Need, importance and scope of renewable energy resources. Advantages and Limitations of renewable energy sources. Present scenario and Future prospects of renewable energy sources. Obstacles to the implementation of renewable energy system. Scope of energy conservation in the domestic, commercial and agricultural sector.

UNIT II

2. **Biogas**

   Bio-gas, Benefits of bio-gas, Composition of Biogas. Technology/Processes for biogas

production. Raw materials required for biogas generation. Site selection of biogas plants. Factors affecting biogas production.

Types of bio gas plants (Fixed Dome type, Floating Gas holder type and Deenbandhu biogas plant). Main parts of biogas plants: digester, gas holder, pressure gauge, gas controlling cocks and meter.

Appliances of biogas plant - burner, heating plate, lamps. Operation, trouble shooting and maintenance of biogas plant. Safety measures in biogas plant.

UNIT III

3. Solar and Biomass Energy

3.1 Solar Energy: Introduction to solar energy. Physical principles of conversion of solar energy radiation into heat. Applications of solar energy. Advantages and limitations of solar energy.

3.2 Biomass Energy: Introduction to biomass and farm residue management and gasification. Utilization of agriculture waste/crop residue. Biomass densification: Briquetting/Pelletization of Biomass. Introduction to various machines used for briquetting of biomass. Biomass combustion using different types of furnaces: fixed-grate, moving-grate and fluidized bed. Introduction to process for production of electricity from Biomass.

UNIT IV

4. Wind Energy Technology

Introduction to wind energy. Basic Principles of wind energy conversion system.

Wind mill and its type and constructional details of windmill - Vertical and Horizontal axis.

Site selection of windmill. Maintenance and performance of windmill.

Applications of wind energy in Agriculture sector. Advantages and disadvantages of wind energy. Electricity generation from wind energy. Wind energy scenario in India.

UNIT V

5. **Tidal Energy and Geothermal Energy**

5.1 Tidal Energy: Introduction and basic principle of Tidal Power. Components of Tidal Power Plant. Classification of Tidal Power Plants (Single Basin and Double Basin System). Advantages and limitations of tidal power plant.

5.2 Geothermal Energy - Introduction of geothermal energy. Geothermal Resources. Prospects of geothermal energy in India. Advantages and disadvantages of geothermal energy over the other form of energy. Applications of geothermal energy.

PRACTICAL EXERCISES

1. Visit the website of Ministry of New and Renewable Energy Sources and prepare the Datasheet of Potential, Present and Future Scenario of Renewable Energy Sources in India.
2. Estimation of wind speed using anemometer.
3. Demonstration of solar energy appliances, manufacturing units and energy parks.
4. Visit to Agricultural Universities/Community/Institutional to study and operate different types of biogas plants.
5. Demonstration of different components of solar appliances: solar water heating system, solar cooker, solar lighting, etc.
6. Visit to nearby renewable power plants and understand the working of different components used in that plant.

RECOMMENDED BOOKS

1. S. P. Sukhatme, "Solar Energy", Tata McGraw Hill Publishing Company Ltd., New Delhi, 1997.
2. B. H. Khan, "Non-Conventional Energy Resources", The McGraw Hill.
3. G.D. Rai, "Non-Conventional Energy Sources", Khanna Publications, New Delhi, 2011.
4. G.D. Rai, "Solar Energy Utilization", Khanna Publisher, New Delhi 110006, 2006.
5. K. C. Khandelwal & S. S. Mahdi, "Biogas Technology – A Practical Handbook", Tata Mc Graw Hill.
6. Mandeep Singh Bhatia , Non-conventional energy sources-Ishan publication.
7. D.P Kothari, K. C. Singal and Rakesh Ranjan ,''Renewable Energy Sources and Emerging Technologies, PHI learning Pvt. Ltd,2nd Edition.

RECOMMENDED WEBSITES

1. www.hau.ac.in
2. www.pau.edu
3. icar.org.in
4. krishi.icar.gov.in
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regularly for development of required skills among the students. This subject contains five units of equal weightage. Teaches should take the students to industry and explain the details of various systems and their components. While imparting instructions, focus should be on conceptual understanding. Training slides and videos should be used to supplement the classroom teaching. Teachers should invite experts from the industries, research and higher level organizations/institutions to engage some sessions on the latest developments taking place on the subject. Some industrial and field visit may also be arranged.

SIXTH SEMESTER

6.1 PROJECT ORIENTED PROFESSIONAL TRAINING

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RATIONALE

Project Oriented Professional Training is aimed at the application of knowledge and competencies gained in the previous semesters in an integrated manner towards addressing an issue in the industry/field, as per the interest and choice of both the industry and student. It also provide opportunities to the students to work relatively independently over extended and comprehensive periods of time. It is expected from the students to get acquainted with desired attributes for industrial/field environment. For this purpose, students are required to work in different establishments of world of work, and develop competencies.

COURSE OUTCOMES

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

CO1: Define the problem statement of the Industrial training as per industry need.
CO2: Develop the problem-solving skills in finding solutions to the problems in the world of work.
CO3: Acquire interpersonal skills and work as a team member.
CO4: Demonstrate the competence to apply knowledge and skills learnt earlier in the context of the project.
CO5: Apply the communication skills in writing and presenting the technical report.

GUIDELINES

The purpose of this project oriented professional training is to expose the students to the world of work and provide professional experience in real life situation. It is suggested that during the training, the student should remain attached with the various sections of industry/field for 3-4 weeks. The student will have to maintain a daily/weekly/monthly diary/work book and submit detailed reports of their activities periodically to their supervisor/teacher. These reports will be certified by the concerned/ authorized officer of the organization where the student is undergoing professional training and doing his/her project.

Each student is required to undergo one Professional Oriented Project according to his/her area of interest and the project report is to be submitted at the end of project. The concerned teacher will guide and supervise the students on work stations (as far as possible) at regular intervals. A systematic plan of action is required to be prepared, well in advance, by the polytechnic in consultation with the organizations where professional training and project is going to be executed. The teacher should clearly specify the expected learning outcomes and schedule on periodic basis, preferably weekly or fortnightly basis, for the whole of the professional project/training period of students. Performa may be developed by the polytechnic Training and Placement Officer in consultation with the teachers and personnel from industry to monitor the progress of the students. The performa should be filled by the students on daily, weekly and monthly basis, and should be duly countersigned by the personnel from industry and concerned teacher/supervisor attached to the particular student. Each teacher is supposed to guide and supervise about 5 – 8 students, depending upon the strength of the students and teachers in the department.

A criteria for assessing student performance by the internal examiner (personnel from industry and supervisor) and external examiner (teachers and experts) are given in table below:

S. No.	Performance criteria for Internal Assessment	Weightage of marks (in %age)
1.	Punctuality and regularity	10%
2.	Initiatives taken by the student in learning at training workplace	10%
3.	Defining problem statement, approach and schedule (Planning)	20%
4.	Level /proficiency of new practical skills acquired	20%
5.	Preliminary Action Plan and Report	40%
TOTAL		**100**

S. No.	Performance criteria for External Assessment	Weightage of marks (in %age)
1.	Project Report	60%
2.	Presentation & Viva voce	40%
Total marks		**100**

Important Notes:

1. This criteria must be followed by the faculty and they may see the daily, weekly and monthly progress/reports, while awarding awards as per the above criteria.
2. Students may visit websites as their learning tool during industrial training, Search videos, animations, text material on internet for preparation of training report during the training period.
3. The external examiner, preferably, may be the person from different industry/organization/institution, who is well versed with the discipline/branch of project-oriented -professional training of the students, so that she/he can properly evaluate the students on the above criteria.

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 Administration & 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. Ashok Poonia, Senior Manager, Maintenance, Casting Maruti Udyog Ltd., Haryana.
9. Sh. Sunil Kumar, Senior Manager, Redlands Ashlyn Motors PLC, North India.
10. Dr. Ashok Kumar, Former Dean, Punjab Agricultural University, Ludhiana
11. Sh. Anil Kumar, Assistant Professor, College of Agriculture Engineering and Technology, Hisar, Haryana.
12. Sh. Jasbir Singh, Officer, Agriculture Research & Development, IRRI South Asia Regional Centre.
13. Sh. Hitesh Kumar, Deputy Secretary (T&P), Haryana State Board of Technical Education, Panchkula.
14. Sh. Davender Kumar, Senior Lecturer, Agriculture Engineering Department, Government Polytechnic, Sirsa, Haryana.
15. Sh. Sanjay Poonia, Lecturer, Agriculture Engineering Department, Government Polytechnic, Sirsa, Haryana.
16. Smt. Meenu Rani, Lecturer, Agriculture Engineering Department, Government Polytechnic, Sirsa, Haryana.
17. Sh. Ranjeet Singh, Lecturer, Agriculture Engineering Department, Government Polytechnic, Sirsa, Haryana.

18. Sh. Jagjit Singh Narang, Senior Lecturer, Mechanical Engineering Department, Government Polytechnic, Ambala, Haryana.
19. Sh. Subhash Chandra Bhoria, Senior Lecturer, Mechanical Engineering Department, Government Polytechnic, Hisar, Haryana.
20. Sh. Harvinder Singh Saini, Senior Lecturer, Mechanical Engineering Department, Senior Lecturer, Government Polytechnic, Ambala, Haryana.
21. Subhash Bhardwaj, Senior Lecturer, Mechanical Engineering Department, Government Polytechnic, Ambala, Haryana.
22. Sh. Pardeep Kumar, Senior Lecturer, Mechanical Engineering Department, Government Polytechnic, Nilokheri, Haryana.
23. Sh. Vikas Sharma, Senior Lecturer, Mechanical Engineering Department, Government Polytechnic, Nilokheri, Haryana.
24. Sh. Parveen Saini, Lecturer, Mechanical Engineering Department, Government Polytechnic, Nilokheri, Haryana.
25. Sh. Rajiv Verma,Senior Lecturer, Mechanical Engineering Department, Government Polytechnic, Adampur, Haryana
26. Sh. Baljeet Siwach, Lecturer, Mechanical Engineering Department, Government Polytechnic, Sonepat, Haryana.
27. Sh. Kapil Sharma, Lecturer, Mechanical Engineering Department, Seth Jai Parkash Polytechnic, Damla, Haryana.
28. Sh, Baltar Singh, Workshop Superintendent, Mechanical Engineering Department, Government Polytechnic, Ambala, Haryana.
29. Sh. Dinesh Mor, Workshop Superintendent, Workshop Department, Government Polytechnic, Sonipat, Haryana.
30. Sh. Manmohan Singh, Workshop Superintendent, Mechanical Engineering Department, Government Polytechnic, Damla, Haryana.
31. Sh. Balwan Singh, Workshop In-charge, Mechanical Engineering Department, Aryabhatt Institute of Technology, Delhi.
32. Sh. Gulab Singh, Workshop Instructor, Mechanical Engineering Department, Seth Jai Parkash Polytechnic, Damla, Haryana.
33. Sh. Ashwani Kumar, Workshop Instructor, Electrical Engineering Department, Government Polytechnic, Damla, Haryana.
34. Sh. Rajneesh Rana, Workshop Instructor, Electronics Engineering Department, Government Polytechnic, Damla, Haryana.

35. Sh. Ankush Aggarwal, Lecturer, Mechanical Engineering Department, Seth Jai Parkash Polytechnic, Damla, Haryana.
36. Ms. Amita, Deputy Director (Acd), Directorate of Technical Education.
37. Dr. Bhajan Lal, Lecturer, Applied Science Department, Government Polytechnic for Women, Sirsa, Haryana.
38. Sh. Anil Nain, Lecturer, Applied Science Department, Government Polytechnic, Hisar, Haryana.
39. Dr. Sarita Mann, Lecturer, Applied Science Department, Government Polytechnic, Ambala, Haryana.
40. Dr. Ashok Kumar, Associate Professor, Applied Science Department, NITTTR, Chandigarh.
41. Smt. Krishna Bhoria, Lecturer, Applied Science Department, Government Polytechnic, Ambala, Haryana.
42. Smt. Pushpa Rani, Senior Lecturer, Applied Science Department, Government Polytechnic, Sonipat, Haryana.
43. Smt. Preetpal Kaur, Guest Faculty, Applied Science Department, Government Polytechnic, Ambala, Haryana.
44. Ms. Monika, Lecturer, Applied Science Department, Seth Jai Parkash Polytechnic, Damla, Haryana.
45. Dr Neena Sharma, English Department, MCM College, Chandigarh.
46. Sh. Satyawan Dhaka, Senior Lecturer, Applied Science Department, Government Polytechnic, Nilokheri.
47. Dr. Ashok Kumar, Associate Professor, Applied Science Department, NITTTR, Chandigarh.
48. Mrs. Sapna Sang, Lecturer, Applied Science Department, Seth Jai Parkash Polytechnic, Damla.
49. Sh. Ravi Bansal, Lecturer, Applied Science Department, Government Polytechnic, Manesar.
50. Mrs. Kiran, Lecturer, Applied Science Department, Government Polytechnic, Sonepat.
51. Dr. Naveen Jha, Assistant Professor, Department of Mathematics, Government Engineering College, Bharatpur.
52. Dr. KC Lachhwani, Assistant Professor, Applied Science, NITTTR, Chandigarh

53. Sh. KG Srinivasa, Professor CSE, IIIT Naya Raipur.

54. Dr. Vidhi Grover, Lecturer, Applied Science Department, Seth Jai Parkash Polytechnic, Damla.

55. Sh. Tavinder Singh, Lecturer, Applied Science Department, Government Polytechnic, Sirsa.

56. Ms. Sunita Rani, Lecturer, Applied Science Department, Government Polytechnic, Ambala.

57. Dr. Rajesh Mehra, Professor and Head, Curriculum Development Centre, NITTTR, Chandigarh.

58. Dr. AB Gupta, Professor and Head, Education & Educational Management Department, NITTTR, Chandigarh.

59. Sh. PK Singla, Associate Professor, Curriculum Development Centre, NITTTR, Chandigarh

60. Dr. SK Gupta, Associate Professor, Curriculum Development Centre, NITTTR, Chandigarh

61. Dr. Meenakshi Sood, Associate Professor, Curriculum Development Centre, NITTTR, Chandigarh

27. APPENDIX

Sr. No.	LIST OF EQUIPMENTS
1.	Miscellaneous Workshop Tools
2.	Primary Tillage Implements(Ploughs etc.)
3.	Secondary Tillage Implements(Harrows etc.)
4.	Sowing & Planting Machinery(Seed Drills, Planters & transplanters)
5.	Interculturing Tools(Cultivators, Hoes etc.)
6.	Fertiliser Distributors & Manure spreaders
7.	Plant Protection Equipments(Sprayers, Dusters etc.)
8.	Harvesting Machinery(Mowers, Reapers etc.)
9.	Diggers
10.	Threshers
11.	Laser Land Levellers
12.	Power Tiller
13.	Horticultural tools
14.	Subsoiler
15.	Puddler
16.	Cage Wheel
17.	Ridger
18.	Seed Trerater
19.	Traditional Implements
20.	Models, Charts/ Drawings & Video CDs for use as Teaching Aids
21.	Centrifugal Pump
22.	Submersible Pump
23.	Inflirtometer Set
24.	Pan Evaporimeter
25.	Sprinkler irrigation system set
26.	Drip irrigation system set
27.	Parshall Flumes, weirs & Notches
28.	Models, Charts/ Drawings & Video CDs for use as Teaching Aids
29.	Diesel engine & Petrol Engine of different make
30.	Tool set for engine dismantling & assembling
31.	Measuring tools
32.	Nozzle testing machine
33.	Cut Section models of diesel engine & Petrol Engine

34.	Cut Section models of two stroke & four stroke Engine
35.	Models, Charts/ Drawings & Video CDs for use as Teaching Aids
36.	Tractors (2-3 tractors of different make & Power)
37.	Air compressor
38.	Tractors washer
39.	Model of Steering System
40.	Model of Clutch & differential
41.	Model of Gear box
42.	Hydraulic trainer
43.	Models, Charts/ Drawings & Video CDs for use as Teaching Aids
44.	Solar cooker-domestic
45.	Solar cooker-parabolic type
46.	Solar water heater(100 liter/day)
47.	Solar Lantern
48.	Solar lighting system with gadgets
49.	Solar photovoltaic water pump
50.	Wind mill model
51.	Models, Charts/ Drawings & Video CDs for use as Teaching Aids
52.	Anemometer
53.	Measuring instruments(verniers caliper,micrometer,height gaguge-1set
54.	Moisture meters of different types
55.	Digital balances
56.	Hot air ovens
57.	Working Lab Models/ Prototypes for different types of dryers used in agro processing industries
58.	Grain storage bins
59.	Refrigerator/ Cold Storge
60.	Working Lab Models/ Prototypes for different types of material handling devices used in agro processing industries e. g. conveyors, elevators
61.	Air screen cleaner-cum-grader-lab model
62.	Working Lab Models/ Prototypes for different types of separators and graders used in agro processing industries
63.	Mini rice sheller
64.	Flour Mill
65.	Pulse Mill(Mini dal mill)
66.	Working Lab Models of oil expellers

67.	Working Lab Models of grinder
68.	Working Lab Models of blender & mixers
69.	Paletting Machine Model
70.	Models, Charts/ Drawings & Video CDs for use as Teaching Aids
71.	Computer with(AutoCAD software) 10 Nos
72.	Printers and Plotters
73.	UPS


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