



UTTARAKHAND BOARD OF TECHNICAL EDUCATION
JOINT ENTRANCE EXAMINATION AND TRAINING, RESEARCH DEVELOPMENT CELL, DEHRADUN
STUDY AND EVALUATION SCHEME FOR DIPLOMA PROGRAMME

BRANCH NAME: AGRICULTURAL ENGINEERING

SEMESTER – IV

Subject Code	Subject	L	T	P	T O T	EVALUATION SCHEME						Total Marks	Credit Point
						Internal		External					
						Theory Max Marks	Practical Max Marks	Theory		Practical			
								Max Marks	Hrs.	Max Marks	Hrs.		
Period/Weeks													
254002	Solid Mechanics	5	-	3	8	30	20	80	2.5	40	3.0	170	4
254006	Manufacturing Technology & Metrology	5	-	3	8	30	20	80	2.5	40	3.0	170	5
254005	Watershed & Forest Management	4	-	4	8	30	20	80	2.5	40	3.0	170	4
254001	Basic Electrical & Electronics Engineering	5	-	3	8	30	20	80	2.5	40	3.0	170	4
254003	Farm Machinery Drawing	-	-	6	6	-	60	80	2.5	-	-	140	5
254004	Operation & Maintenance of Tractor and Farm Machinery	-	-	6	6	-	60	-	-	75	3.0	135	6
254052	Industrial Exposure (Assessment at Inst. Level) +	-	-	-	-	-	20	-	-	-	-	20	1
014054	General Proficiency #	-	-	4	4	-	25	-	-	-	-	25	1
254053	Industrial Training	Industrial Training of 30 days done after 4th Semester would be evaluated in 5th Semester through Report and Viva-voce.										-	
Total		19	-	29	48	120	245	400	-	235	-	1000	30

* Common with other Engineering diploma programmes

General Proficiency will comprise of various co-curricular activities like games, hobby clubs, seminars, declamation contests, extension lectures, NCC, NSS and cultural activities, elementary mathematics, GS & G.K etc.

+ Industrial Exposure compulsory at minimum 1 industry or Department.

Note: 1- Each period will be 50 minutes. 2- Each session will be of 16 weeks. 3- Effective teaching will be at least 12.5 weeks.

Branch Code - 25



**FOURTH SEMESTER
AGRICULTURAL ENGINEERING**

L	T	P
5	-	3

Subject Code : 254002

RATIONALE

Diploma holders in this course are required to analyze reasons for failure of different components and select the material for different applications. For this purpose, it is essential to teach them concepts, principles, applications and practices covering stress, strain, bending moment, shearing force, shafts, columns and springs. Hence this subject has been introduced.

DETAILED CONTENTS

1. Introduction to Material Properties (3 Periods)

Mechanical properties of materials such as elasticity, plasticity, ductility, brittleness, toughness, hardness, tenacity, fatigue, malleability, stiffness. Elastic bodies, plastic bodies and rigid bodies, deformation.

2. Stresses and Strains (10 Periods)

- 2.1 Force, its definition and types, units, different types of loads.
- 2.2 Definition of stress and strain, axial loading, different types of stresses and strains, tensile and compressive stress and strain, elastic limit, Hooke's law, stress-strain curve for ductile and brittle material, salient features of stress-strain curve. Young's modulus of elasticity
- 2.3 Factor of safety, safe stresses, ultimate stress
- 2.4 Stress and strain in straight, stepped bars and taper bar of circular cross section, determination of stress and elongation of a bolt in a bolted joint when subjected to direct external load only
- 2.5 Temperature stresses for single section.
- 2.6 Stress and strain on composite section under axial loading, stress and strain due to temperature variations in homogeneous and composite bars and metallic tyres
- 2.7 Shear load, shear stress and strain, modulus of rigidity, lateral strain, Poisson's ratio
- 2.8 Volumetric strain, bulk modulus. relation between modulus of elasticity, modulus of rigidity and bulk modulus

3. Shear Force and Bending Moment (18 Periods)

- 3.1 Types of beams and types of supports

3.2 Concept of shear force and bending moment, sign convention

3.3 Shear force and bending moment diagram for cantilever and simply supported beams subjected to point load and uniformly distributed loads only. Maximum bending moment and point of contra flexure

4. Theory of Simple Bending (14 Periods)

4.1 Concept of pure bending, neutral axis, moment of resistance, section Modulus, bending equation, bending of simple and flitched beams, beams of uniform strength

4.2 Application of flexural formula for solid rectangular and circular section, Channel section, hollow rectangular and circular section

5. Strain Energy (6 Periods)

5.1 Concept of strain energy, proof resilience and modulus of resilience

5.2 Stresses developed due to gradual, sudden and impact load

5.3 Strain energy stored due to gradual, sudden and impact load

5.4 Strain energy due to bending and torsion

6. Slope and Deflection (10 Periods)

6.1 Introduction, determination of slope and deflection by Macaulay's method, moment area of method

6.2 Simple cases of slope and deflection in simply supported beam with uniformly distributed load on whole of the length and a point load at the centre

6.3 Cantilever beam with uniformly distributed load on whole length and a point load at the end (no derivation of formula)

7. Torsion (9 Periods)

7.1 Pure torsion, torsion equation (relation between twisting moment, shear stress and angle of twist), polar modulus of section

7.2 Assumptions in theory of pure torsion

7.3 Strength of circular solid shaft and hollow shaft in pure torsion

7.4 Power transmitted by shaft

7.5 Torsion in helical springs

8. Springs

(5 Periods)

- 8.1 Laminated spring (semi-elliptical and quarter-elliptical type), determination of number of plates, maximum deflection under axial load
- 8.2 Helical Springs closed coiled and open coiled helical springs subjected to axial load
- 8.3 Angle of twist, strain energy, shear stress and maximum deflection under axial load
- 8.4 Effect of falling load helical spring

9. Columns and struts

(5 Periods)

- 7.1 Definition, Types of column
- 7.2 Buckling load, crushing load
- 7.3 Slenderness ratio.
- 7.4 Factors affecting strength of column
- 7.5 Euler's formula for long columns
- 7.6 End restraints, effective length for different end conditions
- 7.7 Rankine Gordan formula
- 7.8 Direct and eccentric loading with stress diagram
- 7.9 Direct and bending stresses and their combination

LIST OF PRACTICALS

1. Perform tensile test on bars of mild steel .
2. Perform shear test on specimen of two different metals.
3. Carry out bending tests on a steel bar or wooden beam.
4. Perform following impact test:
 - a. Izod impact test
 - b. Charpy test
5. Perform torsion test on specimen of different metals for determination of angle of twist for a given torque.
6. Determine the stiffness of a helical spring and to plot a graph between load and extension.
7. Perform hardness test on metal and finding the Brinell hardness and Rockwell hardness.

INSTRUCTIONAL STRATEGY

1. Use computer based learning aids for effective teaching-learning
2. Expose the students to real life problems.
3. Plan assignments so as to promote problem solving abilities and develop continued learning skills.

RECOMMENDED BOOKS

1. Strength of Materials by R.S. Khurmi; S. Chand and Company, Delhi.
2. Strength of Materials by S. Ramamurtham; Dhanpat Rai Publishing Co.(P) Limited, Delhi.
3. Mechanics of Materials by Kirpal Singh; Standard Publishers, New Delhi.
4. Elements of Strength of Materials by D.R. Malhotra and H.C. Gupta; Satya Parkashan, New Delhi.
5. Mechanics of Solids by VS Prasad; Galgotia Publications, New Delhi.
6. Strength of materials Dr. B.C Puniya & S.Rama Murthi; Laxmi Publication, New Delhi.
7. Mechanics of solids by J.K.Kapoor; Bharat Bharati Prakashan, Meerut

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	3	3
2	10	12
3	18	23
4	14	18
5	6	7
6	10	12
7	9	11
8	5	7
9	5	7
Total	80	100

L	T	P
5	-	3

Subject Code : 254006

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. Hence the following topics are included.

DETAILED CONTENTS

1. Foundry (10 Periods)

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, preparation of cores, defects in moulds and their remedies, types of melting furnaces (pit furnace, tilting furnace, cupola, oil fired and induction furnaces), casting defects and their remedies.

2. Lathes (16 Periods)

Introduction, types of lathes, specifications, description and functions of lathe parts, feed mechanism, drives and transmission, work holding devices, turning tools Lathe operations – plain turning, facing, centring, parting off, undercutting, taper turning, eccentric turning, drilling, reaming, thread cutting and knurling, speeds and feeds of cut. Introduction to capstan and turret lathes, copying lathe and their attachments, difference between capstan and turret lathes and heads, tool holders and tool layout, tool geometry and use of throwaway tips, brazed tools and HSS tools.

3. Shaper and Planers (12 Periods)

Classification of shapers, quick return mechanism, difference between shaper and planer, planer and shaper sizes, classification of planers. Tool and work holding devices

4. Drilling and Milling Machines (10 Periods)

Classification of drilling and milling machines, drilling machine size, kinds of drills, cutting speed, drill holding devices, specification and operation on drilling and milling machines.

5. Finishing Operations

(8 Periods)

Types of machines, methods of grinding, polishing, lapping, buffing, honing super finishing operations and their applications

6. Fabrication Practices

(8Periods)

Various sections of steels such as L, T, I, and C, specification and their welded joints, their methods of production, welding techniques in different positions, gas and electric arc welding

7. Inspection Instruments and Gauges

(16 Periods)

Height gauge, depth gauge, bore gauge, slip gauge, sine bar, measurement of taper by use of slip gauges, limits, fits and tolerances, interchangeability, Go and Not-Go gauges, screw thread micrometer, thread gauge, radius gauge, dial gauge, and gear tooth vernier, hardness checking instruments, coating thickness checking instruments, surface finish checking instruments.

LIST OF PRACTICALS

A- Machine Shop Lathe Machines

- 1- Step turning, taper turning and knurling
- 2- Drilling, boring, counter boring and internal turning
- 3- V- thread cutting .
- 4- Simple exercises on shaper and planer
- 5- Group work on milling machine involving down and climb milling, slab milling and gear cutting

B- Fitting Shop

- 1- To make different keys
- 2- To make limit gauge
- 3- To grind a drill

RECOMMENDED BOOKS

- 1- Workshop Technology by BS Raghuwanshi, Dhanpat Rai & Sons, Delhi
- 2- Manufacturing Technology by M Adithan and Gupta, New Age International (P) Ltd., Delhi.

- 3- Elements of Workshop Technology by SK Choudhary & Hazara, Asia Publishing House
- 4- Workshop Practice by RK Singhal, SK Kataria & Sons, New Delhi.
- 5- Production Technology by HMT, Tata McGraw Hill, New Delhi.
- 6- Workshop Technology Vol. – I, II & III by Chapman, Standard Publishers
- 7- Distributors, New Delhi.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	10	10
2	16	20
3	12	15
4	10	15
5	8	10
6	8	10
711	16	20
Total	80	100

L	T	P
4	-	4

Subject Code : 254005

RATIONALE

A diploma holder in Agricultural Engineering needs to learn about the watershed management & forest management . A course on watershed shall equip the students with the knowledge of the various watershed technologies nad its used in forest management. This course will educate about poly house and other protected cultivation.

1. Introduction

(7periods)

Watershed, watershed development, management, stream order, planning, watershed delineation.

2. PRA, watershed comities, SHGs, problems of watershed, factors affecting watershed. (7 periods)
3. Watershed evaluation , monitoring, GIS and remote sensing and its applications in watershed management. (7periods)
4. Protected cultivation – What and Why in Agriculture (7 periods)
- 5- Protected cultivation Technologies –Raised bed cultivation, mulching, low tunnel and micro irrigation, green house . (5 periods)
6. Forest Ecology and Its Significance. (5 periods)
7. Forest Survey and Mapping. (5 periods)
8. Forest Recreation / Ecotourism. (4Periods)
9. Community Forestry (6Periods)
10. Biodiversity Conservation (6 Periods)
11. Forest Monitoring and Surveillance (5 Periods)

PRACTICALS

1. Study of watershed characteristics
2. Delineation of watershed
3. Study of various watershed management technologies.
4. Preparing watershed plan on map.
5. Study of forest survey.
6. Study tour to nearest national park .

RECOMMENDED BOOKS

1. watershed Planning and management –Rajvir Singh, Yash Publishing House
2. Hydrology and Soil Conservation Engineering – Ghanshyam Das, Prentice Hall
3. Remote Sensing and Image Interpretation, Lille Sand and Kaiffer R., John Willey and Sons
4. Principles of geographical information systems for land resources assessment- P. A. Burrough
5. Davis, L.S.; Johnson, N.K. 1987 ,Forest Management ,McGrawhill Book Company, New York
6. Recknagel, A.B. Bentley, J. 1985 ,Forest Management ,International Book Distributors, Dehra Dun
7. Gupta, M.D. Gangopadhyay, A. K. Bhattacharya, T. Chalraborti, M. (Eds.) 1986 Forestry Development in North East India ,Omsons Publications, Guwahati
8. Shah,S.A. 1988 ,Forestry for People ,Indian Council of Agricultural Research, New Delhi

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	7	10
2	7	10
3	7	10
4	7	10
5	5	9
6	5	8
7	5	8
8	4	8
9	6	9
10	6	9
11	5	9
Total	64	100

L	T	P
5	-	3

Subject Code : 254001

RATIONALE

The objective of the course is to impart basic knowledge and skills regarding electrical and electronics engineering, which diploma holders will come across in their professional life

DETAILED CONTENTS

1. Overview of Electricity:

(04 Periods)

General use and applications of electricity; Use and applications of electricity to agriculture; Advantages of electrical energy over other forms of energy.

2. DC Circuits:

(10 Periods)

Introduction to basic terms: charge, current, voltage, power, and energy; Ohm's law; Power dissipation in resistors; Series and parallel combination of resistors; Kirchhoff's laws; Star-delta conversions; Thevenin's theorem, Norton's theorem, and Maximum-power-transfer theorem; Ideal and practical voltage source; Current source.

3. AC Circuits:

(14 Periods)

Concept of alternating voltage and current; Introduction to basic terms: cycle, frequency, time period, amplitude, instantaneous value, rms value, peak value, phase difference, form factor, and peak factor; Concept of phasor; Phasor diagrams; Concepts of reactance, impedance, admittance, susceptance, and conductance; Concepts of instantaneous power, real power, reactive power, apparent power, complex power, and power factor; Analysis of simple AC circuits; Overview of three-phase AC circuits.

4. Batteries and Solar Cells:

(08 Periods)

Primary and secondary cells; Construction, working, and applications of Lead-Acid; Charging methods for Lead-Acid batteries; Maintenance of Lead-Acid batteries; Series and parallel connection of batteries; Maintenance free batteries; General idea of solar cells, solar panels and their applications.

5. Electrical Machines:

(16 Periods)

Electromagnetic induction; Introduction to magnetic circuits; Principles of

electro mechanical energy conversion; Construction and operation of single phase transformers; Tests of transformers; Efficiency and regulation; Operation of auto transformers & welding transformer;. Types of three-phase induction motors; principle of operation,; Methods of starting and speed-control of three-phase induction motors; Overview of single-phase induction motors.; Construction and operation of synchronous machines; Construction and operation of stepper motors. Applications of single and three phase induction motors.

6. Semiconductors:

(10 Periods)

Classification of materials as conductors, insulators, and semiconductors; Intrinsic and extrinsic semiconductors; p-type and n-type semiconductors; pn-junction diode; Half wave and full wave rectification using diodes; Basic construction and operation of BJT, UJT, JFET, MOSFET, and thyristor.

7. Measuring Instruments:

(10 Periods)

Construction and working principles of PMMC and MI type voltmeters and ammeters; Dynamometer wattmeter; Induction-type energy meters; Measurement of power and energy in three-phase circuits; Use of digital meters (voltmeter, ammeter, and multimeter).

8. Electrical Installation and Safety:

(08 Periods)

Various accessories and parts of electrical installation; Overview of industrial and domestic wiring systems; Common electrical safety measures; Protection and precaution against electrical shock; Treatment of electrical shock; Basic protective devices like fuse, MCB, thermal overload relay, ELCB, and RCCB; Concepts and types of earthing; Protection against lightning.

LIST OF PRACTICALS

1. Verification of Ohm's Law
2. Verification of KCL and KVL
3. Test of charging and discharging of lead-acid battery using hydrometer
4. Connection of a three-phase motor and starter with fuses and reversing of direction
5. Connection of analog and digital single phase energy meter
6. Study of a distribution board for domestic and industrial installation
7. Open-circuit and short-circuit test on a single-phase transformer
8. Star-delta starting of induction motors
9. To draw V-I characteristics of pn-junction diode

10. To draw input and output characteristics of a transistor in CB and CE configurations

RECOMMENDED BOOKS

1. Basic Electrical Engineering by PS Dhongal; Tata McGraw Hill Publishers, New Delhi
2. Basic Electricity by BR Sharma; Satya Prakashan, New Delhi
3. Electrical Machines by SK Bhattacharya; Tata McGraw Hill, New Delhi
4. Experiments in Basic Electrical Engineering by SK Bhattacharya and KM Rastogi, New Age International Publishers Ltd., New Delhi

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	4	5
2	10	13
3	14	16
4	8	10
5	16	20
6	10	13
7	10	13
8	8	10
Total	80	100

L	T	P
-	-	6

Subject Code : 254003

RATIONALE

Diploma Holders are required to read and interpret drawings. Therefore it is essential that they have competency in preparing drawings and sketches of various machine parts. Therefore this subject is essentially required.

DETAILED CONTENT

1. Introduction

Limits and Fits: Limit system – tolerance, limits, deviation, allowance, basic size, design size. Tolerances-fundamental tolerances, fundamental deviation, method of placing limit dimensions.

Fits: Clearance fit, transition fit, interference fit, hole basis system, shaft basis system, tolerance grades.

Calculating values of clearance/interference, hole tolerance and, shaft tolerance with given basic size for common assemblies like H7/g6, H7/m6, H8/u7.

Surface Roughness

Introduction-actual profile, reference profile, datum profile, mean profile, peak-to-valley height, mean roughness index, surface roughness number.

Use of machining symbols in production drawings, indication of surface roughness-indication of special surface roughness characteristics, indication of machining allowance, indication of surface roughness, symbols on drawings, method of indicating surface roughness on given components.

Indicating roughness on a component for: -

1. Surface to be obtained by any production method.
2. Surface to be obtained without removal of material.

2. Shaft Couplings

(2 sheets)

- 2.1 Oldham coupling
- 2.2 Universal coupling

3. Bearings

(5 sheets)

- 3.1 Bush bearing
- 3.2 Foot step bearing
- 3.3 Simple wall bracket

4. Pipe Joints

(3 sheets)

- 4.1 Symbols for piping and layout plan of piping
- 4.2 Flanged joint
- 4.3 Socket and spigot joint
- 4.4 Union joint
5. Screw Jack (1 sheet)
6. Shovel and Sweeps of cultivators (1 sheet)
7. Seed metering devices like fluted rollers, cup feed type and inclined plate type. (1 sheet)
8. Mould board and disk plough components (2 sheets)
9. Sectional view of hand pumps. (1 sheet)

RECOMMENDED BOOKS

1. Machine Drawing by P.S. Gill; S.K. Kataria and Sons, Delhi.
2. Machine Drawing by R.K. Dhawan; S. Chand and Company, Delhi.
3. Machine Drawing by R.B. Gupta; Satya Parkashan, New Delhi.
4. Elements of Agriculture Engg.
5. Machine Drawing by N.D. Bhatt; Charotar Publishing House.

Note:

1. The drawings should include dimensions with tolerances, wherever necessary, and material list according to B.I.S. specifications as per SP 46: 1988.

OPERATION & MAINTENANCE OF TRACTOR AND FARM MACHINERY

Subject Code : 254004

L	T	P
-	-	6

RATIONALE

This is a practice-oriented subject, which will create the ability and develop the skill to carry out different agricultural operations for raising the crops using tractors and matching farm equipment. It will also enable the students to handle and operate the machines and implements used for crop production and carry out the minor repair and adjustments of machines for effective and efficient machinery usage.

DETAILED CONTENTS

1. Familiarization with different gauges and controls of tractors, pre operational checks and precautions
2. Tractor driving practices without implements in limited space like L shape, Circle, “8” etc.
3. Tractor trolley reversing in limited space and turning .
4. Operation of primary tillage equipment in field. Controlling the speed of operation, gear selection, adjustments in the machine for different operations
5. Operation of secondary tillage equipment, seed bed preparation, gear selection, adjustments in machine desired results.
6. Operation of sowing and planting equipment, gear selection, adjustments in the machine for proper seed placement, calibration for proper seed and fertilizer application and care of machines.
7. Operating various plant protection equipment, adjustments, nozzle calibration, and care of equipment and precautions
8. Familiarization of power tillers and their controls, operations of equipment with power tillers with care of machines and precautions.
9. Measurement of speed, slip, draft, field efficiency, field capacity & fuel consumption of tractor during field operations.

Subject Code : 254053

Industrial training provides an opportunity to students to experience the environment and culture of industrial production units and commercial activities undertaken in field organizations. It prepares student for their future role as diploma engineers in the world of work and enables them to integrate theory with practice.

For this purpose, students at the end of fourth semester need to be sent for industrial training for a minimum of 4 weeks duration to be organised during the semester break starting after IV Semester examinations. The concerned HODs along with other teachers will guide and help students in arranging appropriate training places relevant to their specific branch. It is suggested that a training schedule may be drawn for each student before starting of the training in consultation with the training providers. Students should also be briefed in advance about the organizational setup, product range, manufacturing process, important machines and materials used in the training organization.

Equally important with the guidance is supervision of students training in the industry/organization by the teachers. A teacher may guide a group of 4-5 students. A minimum of one visit by the teacher is recommended. Students should be encouraged to write daily report in their diary to enable them to write final report and its presentation later on.

Internal assessment and external assessment have been provided in the study and evaluation scheme of V Semester. Evaluation of professional industrial training report through viva-voce/presentation aims at assessing students understanding of materials, industrial process, practices in industry/field organization and their ability to engage in activities related to problem solving in industrial setup as well as understanding of application of knowledge and skills learnt in real life situations. The formative and summative evaluation may comprise of weightage to performance in testing, general behaviour, quality of report and presentation during viva-voce examination. It is recommended that such evaluations may be carried out by a team comprising of concerned HOD, teachers and representative from industry, if any. The components of evaluation will include the following.

- | | |
|--------------------------------------|-----|
| a) Punctuality and regularity | 15% |
| b) Initiative in learning new things | 15% |
| c) Relationship with workers | 15% |
| d) Industrial training report | 55% |