

P.K.UNIVERSITY, SHIVPURI (MP)
(FACULTY OF ENGINEERING & TECHNOLOGY)



EVALUATION SCHEME & SYLLABUS
FOR
DIPLOMA IN ELECTRICAL ENGINEERING
ON
CHOICE BASED CREDIT SYSTEM (CBCS)

[Effective from the Session: 2025-26]

DIPLOMA IN ELECTRICAL ENGINEERING

Study And Evaluation Scheme For Diploma Programme In EE												
SEMESTER-5												
SUBJECT CODE	SUBJECTS NAME	STUDY SCHEME Periods/Week			Credits	Marks In Evaluation Scheme						Total Marks of Internal & External
						INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT			
		L	T	P		Th	Pr	Tot	Th	Pr	Tot	
DINDUEE501	Industrial Management & Entrepreneurship Development	4	0	0	4	30	-	30	70	-	70	100
DSWITEE502	Switch Gear & Protection	4	0	0	4	30	-	30	70	-	70	100
DINDUEE503	Industrial Electronics & Control	4	0	0	4	30	-	30	70	-	70	100
DELECEE504	Electrical Machine-II	4	1	0	5	30	-	30	70	-	70	100
DELECEE505	Electric Traction	4	0	0	4	30	-	30	70	-	70	100
DINDUEE506	Industrial Electronics and Control Lab	0	0	2	1	-	25	25	-	25	25	50
DINTEEE507	Integrative communication Lab	0	0	2	1	-	25	25	-	25	25	50
DELECEE508	Electrical Machine-II Lab	0	0	2	1	-	25	25	-	25	25	50
DINDUEE509	Industrial Training	-	-	-	2	-	-	-	-	-	50	50
Total		20	1	6	26	150	75	225	350	75	475	700

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3rd Year /5th Semester

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DINDUEE501:
INDUSTRIAL MANAGEMENT AND ENTREPRENEURSHIP DEVELOPMENT

SECTION – A

ENTREPRENEURSHIP

1. Introduction

- 1.1 Concept /Meaning and its need
- 2 1.2 Qualities and functions of entrepreneur and barriers in entrepreneurship
- 1.3 Sole proprietorship and partnership forms and other forms of business organizations
- 1.4 Schemes of assistance by entrepreneurial support agencies at National, State, District –level, organization: NSIC, NRDC, DC, MSME, SIDBI, NABARD, NIESBUD, HARDICON Ltd., Commercial Banks, SFC's TCO, KVIB, DIC, Technology Business Incubators (TBI) and Science and Technology Entrepreneur Parks

2. Market Survey and Opportunity Identification/Ideation (04 Periods)

- 2.1 Scanning of the business environment
- 2.2 Salient features of National and Haryana State industrial policies and resultant business opportunities
- 2.3 Types and conduct of market survey
- 2.4 Assessment of demand and supply in potential areas of growth
- 2.5 Identifying business opportunity
- 2.6 Considerations in product selection
- 2.7 Converting an idea into a business opportunity

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3. Project report Preparation (06 Periods)

- 3.1 Preliminary project report
- 3.2 Detailed project report including technical, economic and market feasibility
- 3.3 Common errors in project report preparations
- 3.4 Exercises on preparation of project report
- 3.5 Sample project report

SECTION –B

MANAGEMENT

4. Introduction to Management (06 Periods)

- 4.1 Definitions and importance of management
- 4.2 Functions of management: Importance and process of planning, organizing, staffing, directing and controlling
- 4.3 Principles of management (Henri Fayol, F.W. Taylor)
- 4.4 Concept and structure of an organization
- 4.5 Types of industrial organizations and their advantages
- 4.6 Line organization, staff organization
- 4.7 Line and staff organization
- 4.8 Functional Organization

5. Leadership and Motivation (08 Periods)

- 5.1 Leadership: Definition and Need, Qualities and functions of a leader, Manager Vs. leader, Types of leadership, Case studies of great leaders
- 5.2 Motivation: Definition and characteristics, Importance of self-motivation, Factors affecting motivation, Theories of motivation (Maslow, Herzberg, Douglas, McGregor)

6. Management Scope in Different Areas (14 Periods)

- 6.1 Human Resource Management: Introduction and objective, Introduction to Man power planning, recruitment and selection, Introduction to performance appraisal methods
- 6.2 Material and Store Management: Introduction functions, and objectives, ABC Analysis and EOQ
- 6.3 Marketing and sales: Introduction, importance, and its functions, Physical distribution, Introduction to promotion mix, Sales promotion
- 6.4 Financial Management: Introductions, importance and its functions, knowledge of income tax, sales tax, excise duty, custom duty, VAT, GST

7. Work Culture (08 Periods)

- 7.1 Introduction and importance of Healthy Work Culture in organization
- 7.2 Components of Culture
- 7.3 Importance of attitude, values and behavior
- 7.4 Behavioral Science – Individual and group behavior.
- 7.5 Professional ethics – Concept and need of Professional Ethics and human values.

8. Basic of Accounting and Finance (10 Periods)

- 8.1 Basic of Accounting: Meaning and definition of accounting, Double entry system of book keeping, Trading account, PLA account and balance sheet of a company
- 8.2 Objectives of Financial Management: Profit Maximization v/s Wealth Maximization

9. Miscellaneous Topics (10 Periods)

- 9.1 Total Quality Management (TQM): Statistical process control, Total employees Involvement, Just in time (JIT)
- 9.2 Intellectual Property Right (IPR) : Introduction, definition and its importance, Infringement related to patents, copy right, trade mark

RECOMMENDED BOOKS

- 1. A Handbook of Entrepreneurship, Edited by BS Rathore and Dr JS Saini; AapgaPublications, Panchkula (Haryana)
- 2. Entrepreneurship Development and Management by J.S.Narang; Dhanpat Rai & Sons, Delhi.
- 3. Entrepreneurship Development by CB Gupta and P Srinivasan, Sultan Chand and Sons, New Delhi
- 4. Handbook of Small Scale Industry by PM Bhandari
- 5. Entrepreneurship Development and Management by MK Garg
- 6. E-books/e-tools/relevant software to be used as recommended by AICTE/ NITTTR, Chandigarh.

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DSWITEE502: SWITCH GEAR AND PROTECTION

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DETAILED CONTENTS

- 1. Faults (15 Periods)**
Types of faults, three phase symmetrical faults, effects of faults on system reliability and stability, abnormalities, short circuits and their effects, representation of fault conditions through single line diagrams
- 2. Switch gear (24 Periods)**
 - 2.1 Purpose of protective gear, characteristics of a protection system.
 - 2.2 Classification of fuses H.V. Fuses, application and working, grading and co-ordination L.V. fuses, selection of fuses, characteristics
 - 2.3 Isolators and switches, outdoor isolators, functions, air break switches, braking capacity of switches.
 - 2.4 Circuit breakers :- requirements of circuit breakers, definition of terms associated with circuit-breakers, reasons for arc formation, principles of arc extinction, types of circuit breakers, comparison with oil circuit breaker, classification, rating of circuit breakers, working of different types of air and oil circuit breakers, specification of circuit breakers, maintenance schedule, SF- 6 and Vacuum circuit breakers.
 - 2.5 Relays: Requirement of relays, operation principles, induction type over current, directional over current, differential, percentage differential relays working, applications and characteristics, basic principles of static relays. Introduction too distance relay.
- 3. Protective Schemes (15 Periods)**
 - 3.1 Protection of alternators, stator faults, and rotor faults, mechanical conditions, external faults - their reasons, effect and protections used.
 - 3.2 Protection of power transformer: types of faults, its effects, types of protective schemes over current, earth fault, differential protection, Buckholz devices, winding temp. Protection.

- 3.3 Motor protection: types of faults and protection in motors, thermal relays, protection of small motors, under voltage protection.
- 3.4 Protection of feeders: radial, parallel and ring feeders' protection, directional time and current graded schemes, differential protection.

4. Protection Against Over Voltages (15 Periods)
 Causes of over voltages, travelling wave's earth wire, protective zone, lightening arrestors, space-gap and electrolytic arrestors, surge absorber, location and rating of lightening arrestors. Thyrite lightening arrestor.

5. Different Type of Sub-stations (15 Periods)

- 5.1 Layout, single line diagram, bus bar arrangement, equipment, their functions, accessories, study of protective schemes, batteries and their maintenance, operation of small sub-stations.
- 5.2 Reactors: types of reactors, bus bar reactor, tuning reactor, arc- suppression reactor, connection of reactors in power stations, uses of reactors.
- 5.3 Neutral grounding:- types of grounding solid grounding, reactance grounding, arc suppression, coil grounding, choice of method of neutral earthing, grounding of sub-stations, grounding of line structure and substation equipment.
- 5.4 Concept of G.I.S. (Gas Insulated Substation)

RECOMMENDED BOOKS

- 1. Switchgear and Protection by NagrathKathan; TMH
- 2. Switchgear and Protection by Soni Gupta &Bhatnagar; Dhanpat Rai & Sons
- 3. Switchgear and Protection by Sunil S. Rao; Dhanpat Rai & Sons
- 4. Switchgear and Protection by HarnoonAsfaqHussain; Khanna Publications
- 5. Switchgear and Protection by J.B. Gupta; Kataria& Sons
- 6. Switchgear and Protection by U.A Bakshi; Technical Publications, Pune

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DINDUEE503: INDUSTRIAL ELECTRONICS AND CONTROL

DETAILED CONTENTS

- 1. Introduction to SCR (18 Periods)**
 - 1.1 Power diode characteristics, application of general purpose diode, fast recovery diode and Schottkey diode, use in R, RLseries circuit.
 - 1.2 Construction and working principles of an SCR, two transistor analogy and characteristics of SCR
 - 1.3 SCR specifications and rating
 - 1.4 Construction, working principles and V-I characteristics of DIAC, TRIAC and Quadriac
 - 1.5 Basic idea about the selection of heat sinks for SCR and TRIACS
 - 1.6 Methods of triggering a Thyristor. Study of triggering circuits
 - 1.7 UJT, its Construction, working principles and V-I characteristics, UJT relaxation oscillator
 - 1.8 Commutation of Thyristors
 - 1.9 Series and parallel operation of Thyristors
 - 1.10 Applications of SCR, TRIACS and Quadriac such as light intensity control, speed control of DC and universal motor, fan regulator, battery charger etc.
 - 1.11 dv/dt and di/dt protection of SCR.
- 2. Controlled Rectifier (12 Periods)**
 - 1.1 Single phase half wave controlled rectifier with resistive load and inductive load, concept of freewheeling diode.
 - 1.2 Single phase half controlled full wave rectifier
 - 1.3 Single phase fully controlled full wave rectifier
 - 1.4 Single phase full wave centre tapped rectifier
 - 1.5 Three phase full wave half controlled bridge rectifier
 - 1.6 Three phase full wave fully controlled bridge rectifier
- 3. Inverters, Choppers, Dual Converters and Cyclo Convertors (12 Periods)**
 - 3.1 Inverter-introduction, working principles, voltage and current driven series and parallel inverters and applications
 - 3.2 Choppers-introduction, types of choppers and their working

- principles and applications
- 3.3 Dual converters-introduction, working principles and applications
- 3.4 Cyclo-converters- introduction, types, working principles and applications

4. Thyristor Control of Electric Drives

(18 Periods)

- 4.1 DC drives control (Basic Concept)
- 4.2 Half wave drives
- 4.3 Full wave drives
- 4.4 Chopper drives
- 4.5 AC drives control
- 4.6 Phase control
- 4.7 Variable frequency a.c. drives
- 4.8 Constant V/F application
- 4.9 Voltage controlled inverter drives
- 4.10 Constant current inverter drives
- 4.11 Cyclo convertors controlled AC drives
- 4.12 Slip control AC drives

5 Uninterrupted power supplies

(12 Periods)

- 5.1 UPS online, off line
- 5.2 Storage devices (batteries)
- 5.3 SMPS, CVT

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DELECEE504: ELECTRICAL MACHINE- II

DETAILED CONTENTS

1. 3 Phase Induction Motors **(25 Periods)**

- 1.1 Productions of rotating magnetic field in 3 phase winding.
- 1.2 Salient constructional features of squirrel cage and slip ring 3-phase induction motors
- 1.3 Principle of operation, slip and its significance
- 1.4 Locking of rotor and stator fields
- 1.5 Rotor resistance, inductance, emf and current
- 1.6 Relationship between rotor copper losses, slip and rotor input power.
- 1.7 Power flow diagram of an induction motor
- 1.8 Factors determining the torque
- 1.9 Torque-slip curve, stable and unstable zones
- 1.10 Effect of rotor resistance upon the torque slip curve
- 1.11 Double cage rotor motor and its applications
- 1.12 Starting of 3-phase induction motors, DOL, star-delta, auto transformer starter.
- 1.13 Causes of low power factor of induction motors
- 1.14 Testing of 3-phase motor on no load and blocked rotor test and to find efficiency
- 1.15 Method of Speed control of induction motor
- 1.16 Harmonics and its effects, cogging and crawling in Induction Motors.
- 1.17 Specifications and ratings of induction motors.

2. Single Phase Motors **(18 Periods)**

- 2.1 Single phase induction motors; Construction characteristics, specifications and applications.
- 2.2 Nature of field produced in single phase induction motor-double revolving field theory.
- 2.3 Split phase induction motor
 - 2.3.1 Capacitor start, capacitor run, capacitor start and run motor
 - 2.3.2 Shaded pole motor
- 2.4 Alternating current series motor and universal motors, construction,

2.5 Single phase synchronous motor

2.5.1 Reluctance motor

2.5.2 Hysteresis motor

3. Synchronous Machines (25 periods)

- 3.1 Main constructional features of synchronous machine including commutator and brushless excitation system
- 3.2 Generation of three phase emf
- 3.3 Concept of distribution factor and coil span factor and emf equation Armature reaction at unity, lag and lead power factor
- 3.4 Equivalent circuit diagram of synchronous machine
- 3.5 Concept of voltage regulation. Determination of voltage regulation by synchronous impedance method.
- 3.6 Operation of single synchronous machine independently supplying a load.
- 3.7 Concept of infinite bus bar. Need and necessary conditions of parallel operation of alternators, synchronizing an alternator (Synchroscope method) with the bus bars
- 3.8 Operation of synchronous machine as a motor –its starting methods
- 3.9 Effect of change in excitation of a synchronous motor, V curve, Concept of synchronous condenser.
- 3.10 Concept and cause of hunting and its prevention
- 3.11 Specification, rating and cooling of synchronous machines
- 3.12 Applications of synchronous machines

4. Special Purpose Machines (16 periods)

Construction, working principle and application of linear induction motor, stepper motor, AC Servomotor, Submersible Motor,

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DELECEE505: ELECTRIC TRACTION

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- 1. Introduction (05 periods)**
Electric traction system and its advantages over other systems, types of electric traction systems. Traction systems for India.
- 2. Electric Traction drive (9 periods)**
Suitability of electric traction drives- D.C. series motor, A.C. series motor, 3 phase induction motor, characteristics of electric traction drives, special design requirements, methods of starting and speed control, different methods of braking, plugging, rheostatic, regenerative.
- 3. Power Supply of Electric Traction (10 periods)**
Different systems of power supplies, their chronological evaluation, power supply arrangement i.e. traction substation major equipment, transformer, circuit breaker, interrupter, protection system, remote control system. Design consideration.
- 4. Mechanics of traction: (10 periods)**
System of units, speed time curves, their construction, simplification and interpretation for main line, suburban routes, tractive effort, specific energy consumption and factors effecting it. Weight transfer due to torque coefficient of adhesion.
- 5. Rectification equipment: (7 periods)**
Equipment required for rectification, their brief
- 6. Overhead equipment (7 periods)**
Design aspects of overhead equipment catenary and its types, practical aspects of working, maintenance of overhead equipment, current collection system, and their requirements.
- 7. Track Circuits (12 periods)**
D.C. and A.C. track circuits, signals for traffic control.
- 8. Supervisory Remote Control (12 periods)**
System of remote control, its advantages, mimic diagram, remote control system and network remote control centre (R.C.C.)
- 9. Rail and Return Path (12 periods)**
Earth return protection of underground equipment, Negative booster, voltage distribution on rails.

RECOMMENDED BOOKS

1. Electric Traction by J. Upadhyay; Allied Publisher Limited, New Delhi
2. Modern Electric Traction by H. Pratap; Dhanpat Rai & Sons, New Delhi
3. Electric Traction by A.T. Dover; Mcmillan Dhanpat Rai & Sons, New Delhi
4. Electric Traction Handbook by R.B. Brooks; Sir Isaac Pitman and Sons Ltd., London

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DINDUEE506: INDUSTRIAL ELECTRONICS & CONTROLLAB

LIST OF PRACTICALS

1. To draw V-I characteristics of an SCR
2. To draw V-I characteristics of a TRIAC
3. To draw V-I characteristics of a DIAC
4. To draw uni-junction transistor characteristics
5. Observe the output wave of an UJT relaxation oscillator
6. Observe the wave shape across SCR and load of an illumination control circuit
7. Fan speed regulator using TRIAC Quadriac (fabrication of this circuit)
8. Speed-control of a DC shunt motor or universal motor
9. To observe the output wave shape on CRO of
 - (a) Single phase half controlled full wave rectifier
 - (b) Single phase controlled rectifier

BOOKS RECOMMENDED

1. Industrial Control Electronics. John Webb, Kevin Greshock, Maxwell, Macmillan International editions.
2. Fundamentals of Power Electronics by S Rama Reddi, Narosa Publishing House Pvt. Ltd, New Delhi
3. Power Electronics, Circuits Devices and Applications by Mohammad H. Rashid
4. Power Electronics by PC Sen

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DINTEEE507: INTEGRATIVE COMMUNICATION LAB

DETAILED CONTENTS

PERSONALITY DEVELOPMENT

1. Introduction to Personality Development

AIM, Skills, Types of Skills, LIFE SKILLS VS OTHER SKILLS, Concept of Life Skills. Ten core Life Skills identified by WHOM

2. Factors Influencing / Shaping Personality:

Introduction, Physical and Social Factors Influencing / Shaping Personality (Hereditary, Self-Development, Environment, Education, Life-situations) psychological & Philosophical Factors Influencing / Shaping Personality past Experiences, Dreams and Ambitions, Self-Image, Values)

3. Self-Awareness – 1

DIMENSIONS OF SELF AWARENESS (Self Realization, Self-Knowledge or Self Exploration, Self Confidence, Self-Talk, Self-Motivation, Self Esteem, Self-Image, Self-Control, Self-Purpose, Individuality and Uniqueness, Personality, Values, Attitude, Character), self-realization & self-exploration through swot analysis and johari window,

4. Self-Awareness – 2

SYMPATHY VS EMPATHY AND ALTRUISM, Importance of Empathizing with Others,

5. Self-Awareness – 3

Self-Awareness through Activity, Body Image (What is Body Image, What Decides our Body Image, What is Poor Body Image, what are the Harmful Effects of Poor Body Image), Tackling Poor Body Image (Enhance Self-Esteem, Build up Critical Thinking, Build up Positive Qualities, Understand Cultural Variation, Dispel Myths, Utilize Life Skills)

6. Change Your Mind Set

What is Mindset, HOW TO CHANGE YOUR MINDSET (Get the Best? Information Only, Make the best people your role Model, Examine Your Current Beliefs, Shape Your Mindset with vision and Goals, Find Your Voice, Protect Your Mindset, Let Go of Comparisons, put an end to Perfectionism, Look at the Evidence, Redefine What Failure Means, Stop Worrying about What —People Think

INTERPERSONAL SKILLS

7. Interpersonal Relationship and Communication

Interpersonal relationship, forms of interpersonal relationship must have in an interpersonal relationship, interpersonal relationship between a man and a woman (passion, intimacy, commitment), relationship between friends,

Role of Communication in Interpersonal relationship (Take Care of Your Tone and Pitch, Choice of Words is Important in Relationships, Interact Regularly, Be Polite, Try To Understand The Other Person's Point Of View As Well as, Individuals can also communicate Through Emails,

8. Non-Verbal Communication Skills

Non-Verbal Communication, We Communicate with Our Eyes, Communication with Facial Expression, a Good Gesture, Appearance, Posture and Gait, Proximity & Touch), IMPORTANCE OF LISTENING, Characteristics of Good and Effective Listener (Is Attentive, Do Not Assume, Listen for Feelings and Facts, Concentrate on the Other Speakers Kindly and Generously, Opportunities)

9. Communication Skills Activities

in Making Collages, Making Advertisements, PPT Preparation & Presentation, Speaking -Seminars, Group Discussions, Debates, Extempore Speeches, Listening to an audio clip and telling its gist, Answering a Telephone call, making enquiries, General tips Pronunciation, Tone, Pitch, Pace, Volume, relevance, brief, simple Reading Newspaper, Magazines (Current Affairs, Economic magazines, Technical magazines), How to read a Report, article, Writing- Resume Writing, Writing joining report, Notice Writing, Report making, Proposal writing, Advertisement, Notice for tender, Minutes writing, E-Mail writing, Listening News, Listening to audio clips.(Lecture, poetry, speech, songs),

10. Body Language Skills

Introduction, what is Body Language, Body Language Parts, Personal Space Distances (Intimate Distance, Personal Distance, Social Distance, Public Distance), IMPORTANT BODYLANGUAGE SIGNS AND THEIR MEANING

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DELECEE508: ELECTRICAL MACHINE -II LAB

LIST OF PRACTICALS

1. Determination of efficiency by (a) no load test and blocked rotor test on an induction motor (b) direct loading of an induction motor (refer BIS code)
2. Determination of effect of rotor resistance on torque speed curve of an induction motor Observe the performance of a ceiling fan (I- ϕ) induction motor) without capacitor
3. Determine the effect of change in capacitor on the performance of 1-phase induction motor and reverse the direction of motor.
4. To plot relationship between no load terminal voltage and excitation current in asynchronous generator at constant speed
5. Determination of the relationship between the voltage and load current of an alternator, keeping excitation and speed constant
6. Determination of the regulation and efficiency of alternator from the open circuit and short circuit test
7. Determination of the effect of variation of excitation on performance of a synchronous motor

RECOMMENDED BOOKS

1. Electrical Machines by SK Bhattacharya; Tata McGraw Hill, New Delhi
2. Electrical Machine by B.L.Thareja; S.ChandPublicaion, New Delhi
3. Electrical Machines by SK Sahdev; Uneek Publications, Jalandhar
4. Electrical Machines by Nagrath and Kothari; Tata McGraw Hill, New Delhi
5. Electrical Engineering by JB Gupta; SK Kataria and sons, New Delhi
6. Electrical Machines by Samarjit Ghosh; Pearson Education (Singapore) Pvt, Ltd.Delhi
7. E-books/e-tools/relevant software to be used as recommended by AICTE/UBTE/NITTTR, Chandigarh.

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DINDUEE509: INDUSTRIAL TRAINING

It is needless to emphasize further the importance of Industrial Training of students during their 3 years of studies at Polytechnics. It is industrial training, which 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. Polytechnics have been arranging industrial training of students of various durations to meet the above objectives.

This document includes guided and supervised industrial training of 4 weeks duration to be organized during the semester break starting after second year i.e. after 4th 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. Students should be encouraged to write daily report in their diary to enable them to write final report and its presentation later on.

An external assessment of 50 marks has been provided in the study and evaluation scheme of 5th 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.

Teachers and students are requested to see the footnote below the study and evaluation scheme of 4th semester for further details.

The teacher along with field supervisors will conduct performance assessment of students. The components of evaluation will include the following:

Punctuality and regularity 15%
Initiative in learning new things 15%
Presentation and VIVA 15%
Industrial training report 55%

