6.1 BASICS OF MANAGEMENT

L	T	P
3	-	-

RATIONALE

The diploma holders are generally expected to take up middle level managerial positions, their exposure to basic management principles is very essential. Topics like Structure of Organization, Leadership, Motivation, Ethics and Values, Customer Relationship Management (CRM), Legal Aspects of Business, Total Quality Management (TQM), Intellectual Property Rights (IPR) etc. have been included in the subject to provide elementary knowledge about these management areas.

DETAILED CONTENTS

1. Principles of Management (06 hrs)

   1.1. Introduction, definition and importance of management.

   1.2. Functions of Management
   Planning, Organizing, Staffing, Coordinating, Directing, Motivating and Controlling.

   1.3. Concept and Structure of an organization

   Types of industrial organization
   a) Line organization
   b) Functional organization
   c) Line and Functional organization

   1.4. Hierarchical Management Structure
   Top, middle and lower level management

   1.5. Departmentalization
   Introduction and its advantages.

2. Work Culture (06 hrs)

   2.1. Introduction and importance of Healthy Work Culture in organization
   2.2. Components of Culture
   2.3. Importance of attitude, values and behaviour
   Behavioural Science – Individual and group behaviour
   2.4. Professional ethics – Concept and need of Professional Ethics

3. Leadership and Motivation (06 hrs)

3.1. Leadership
- 3.1.1. Definition and Need of Leadership
- 3.1.2. Qualities of a good leader
- 3.1.3. Manager vs. leader

3.2. Motivation
- 3.2.1. Definition and characteristics of motivation
- 3.2.2. Factors affecting motivation
- 3.2.3. Maslow's Need Hierarchy Theory of Motivation

3.3. Job Satisfaction

4. Legal Aspects of Business: Introduction and need (06 hrs)

4.1. Labour Welfare Schemes
- 4.1.1. Wage payment : Definition and types
- b) Incentives: Definition, need and types

4.2. Factory Act 1948

4.3. Minimum Wages Act 1948

5. Management Scope in different Areas (12 hrs)

5.1. Human Resource Development

- 5.1.1. Introduction and objective
- 5.1.2. Manpower Planning, recruitment and selection
- 5.1.3. Performance appraisal methods

5.2. Material and Store Management

- a) Introduction, functions and objectives of material management
- b) Purchasing: definition and procedure
- c) Just in time (JIT)

5.3. Marketing and Sales

- a) Introduction, importance and its functions
- b) Difference between marketing and selling
- c) Advertisement- print media and electronic media
- d) Market-Survey and Sales promotion.

5.4. Financial Management – Introduction

- 5.4.1. Concept of NPV, IRR, Cost-benefit analysis

5.4.2. Elementary knowledge of Income Tax, Sale Tax, Excise duty, Custom duty, Provident Fund

5.5 Maintenance Management

5.5.1 Concept

5.5.2 Preventive Maintenance

6. Miscellaneous topics (12 hrs)

6.1. Customer Relationship Management (CRM)

a) Definition and Need

b) Types of CRM

c) Customer satisfaction

6.2. Total Quality Management (TQM)

a) Inspection and Quality Control

b) Concept of Quality Assurance

c) TQM

6.3. Intellectual Property Rights (IPR)

3.3.1. Introduction, definition and its importance

3.3.2. Infringements related to patents, copyright, trade mark

INSTRUCTIONAL STRATEGY

It is observed that the diploma holders generally take up middle level managerial positions, therefore, their exposure to basic management principles is very essential. Accordingly students may be given conceptual understanding of different functions related to management. Some of the topics may be taught using question answer, assignment or seminar method. The teacher will discuss success stories and case studies with students, which in turn, will develop appropriate managerial qualities in the students. In addition, expert lectures may also be arranged from within the institutions or from management organizations. Appropriate extracted reading material and handouts may be provided.

RECOMMENDED BOOKS

1. Principles of Management by Philip Kotler TEE Publication
2. Principles and Practice of Management by Shyamal Bannerjee: Oxford and IBM Publishing Co, New Delhi.
3. Financial Management by MY Khan and PK Jain, Tata McGraw Hill Publishing Co., 7, West Patel Nagar , New Delhi.
4. Modern Management Techniques by SL Goel: Deep and Deep Publications Pvt Limited , Rajouri Garden, New Delhi.
5. Management by James AF Stoner, R Edward Freeman and Daniel R Gilbert Jr. : Prentice Hall of India Pvt Ltd, New Delhi.
6. Essentials of Management by H Koontz, C O' Daniel , McGraw Hill Book Company, New Delhi.
7. Marketing Management by Philip Kotler, Prentice Hall of India, New Delhi
8. Total Quality Management by DD Sharma, Sultan Chand and Sons, New Delhi.
9. Intellectual Property Rights and the Law by Dr. GB Reddy.
10. Service Quality Standards, Sales & Marketing Department, Maruti Udyog Ltd.
11. Customer Relationship Management: A step-by-step approach, Mohamed & Sagadevan Oscar Publication, Delhi
12. Customer Relation Management, Sugandhi RK, Oscar Publication, Delhi.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (hrs)	Marks Allotted (%)
1.	06	15
2.	06	10
3.	06	15
4.	06	10
5.	12	25
6.	12	25
Total	**48**	**100**

6.2 METROLOGY AND INSTRUMENTATION

L	T	P
4	-	2

RATIONALE

Metrology is the science of measurement, Diploma holders in this course are responsible for ensuring process and quality control by making measurements and carrying out inspection of various parameters. For this purpose, knowledge and skills about various measuring instruments are required. The aim of this subject is to develop knowledge and skills regarding various measuring instruments amongst the students.

DETAILED CONTENTS

1. Introduction (06 hrs)

   1.1 Definition of metrology
   1.2 Standard of measurement
   1.3 Types of Errors - Controllable and random errors
   1.4 Precision, accuracy, sensitivity, hystersis, response time, repeatability, calibration, uncertainty of measurement, interchangability.
   1.5 Standardization and standardizing organizations

2. Linear and Angular Measurement (18 hrs)

   2.1 Construction features and use of instruments for non precision linear measurement: steel rule, callipers, surface plate, angle plate, V-block.
   2.2 Construction features and use of instruments for precision measurements : vernier calipers, vernier height and depth gauges, micrometers.
   2.3 Slip gauges, Indian standards of slip gauges, sets of slip gauges, use of slip gauges.
   2.4 Cylinder bore gauges, feeler and wire gauges. Checking flatness, roundness and squareness
   2.5 Comparators – Characteristics, uses, working principles of different types of comparators: mechanical, electrical, electronics and pneumatic .
   2.6. Construction and use of instruments for angular measurements: bevel protector, sine bar, angle gauges, clinometer, angle dekker. Optical instruments for angular measurement, auto collimator.

3. Measurement of Surface Finish (06 hrs)

   3.1 Terminology of surface roughness.
   3.2 Concept of primary texture and secondary texture.
   3.3 Factors affecting surface finish.
   3.4 CLA, RMS and RA value.
   3.5 Principle and operation of stylus probe instruments. Tomlinson surface meter and Taylor surface talysurf.

4. Measurements of Screw threads and Gauges (08 hrs)

4.1 Measurement of screw threads- Introduction, measurements of external and core diameters, checking of pitch and angle of threads with gauges.
4.2 Measurements of gears (spur) – Measurement of tooth thickness, pitch,
4.3 Profile projector, Coordinate Measuring Machine (CMM), Tool maker's microscope.

5. Instrumentation (08 hrs)

5.1 Various types of instruments used for mechanical quantities such as displacement, velocity, acceleration, speed and torque. Use of transducers and electronic counters, stroboscope, vibrating reeds and tachometers.
5.2 Strain gauge – use of strain gauge and load cells

6. Quality Control (18 hrs)

6.1. Quality control, SQC, function of quality control, quality cost, factors affecting quality of product.
6.2. Inspection need, types of inspection and stages of inspection
6.3. Statistical Quality Control – Definition
6.4. Process Capability
6.5. Introduction to Control Charts(X bar, R,p,c) and their simple applications
6.6. Concepts of ISO 9000, ISO 14000
6.7. Total Quality Management
- Seven QC tools, Kaizan, 5S,

Note: There should be a visit to established metrology lab to familiarize students with purpose and need of metrology.

LIST OF PRACTICALS

1. Internal and external measurements with vernier calliper and microscope
2. Measurement of linear dimensions with height gauge and depth gauge.
3. Measurement of flatness, concentricity with dial indicator
4. Use of feeler gauge, wire gauege, radius gauge and fillet gauges for checking of standard parameters.
5. Use of plain plug and ring gauge, taper plug and ring gauge, thread plug and ring gauge and snap gauges.
6. Measurement of Angle using;
   i) Cylinderical rollers and spherical balls and slip gauges
   ii) Bevel protector
   iii) Sine Bar/Sine Table , Slip Gauges, Height Gauge and dial indicator.
   iv) Angle deckor.
7. Measurement of spur gear characherstics;
   i) Measurement over teeth (M.O.T) by using flange/Disc micrometer.

ii) P.C.D run-out using bench centre, mandrel, cylinderical pin and dial indicator.
iii) Composite error using Gear Roller Tester and Master Gear.

8. Measurement of thread parameters by using tool maker's microscope.
9. Measurement of effective diameter of external threads by 2-wire and 3-wire method.
10. Measurement of cylindrical bore using cylinder bore gauge for bore diameter, ovality and taper.
11. Measurement of worn out IC engine piston clearance between cylinder and piston.
12. Measurement of surface roughness using surface roughness tester.
13. Measurement of co-ordinates of two or more than two holes using surface plate, angle plate, Height Gauge, dial indicator and slip gauges.
14. Measurement of a profile using profile projector.
15. Study and use of Auto-Collimator.

INSTRUCTIONAL STRATEGY

1. Demonstrate use of various measuring instruments while imparting theoretical instructions.
2. Stress should be laid on correct use of various instruments.

RECOMMENDED BOOKS

1. Engineering Metrology by RK Jain; Khanna Publishers, New Delhi.
2. A Text Book of Production Engineering by RC Sharma; S Chand and Company, New Delhi.
3. Metrology Laboratory Manual by M Adithan and R Bahl; NITTTR, Chandigarh.
4. Engineering Metrology by RK Rajput; SK Kataria and Sons, Ludhiana.
5. Metrology & Instrumentation by Aulakh & Pathania; Eagle Prakashan, Jalandhar

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	06	10
2	18	26
3	06	10
4	08	12
5	08	12
6	18	30
Total	**64**	**100**

6.3 AUTOMOBILE ENGINEERING

L	T	P
4	-	2

RATIONALE

These days, automobile has become a necessity instead of luxury. The diploma holders in this course are required to supervise production and repair and maintenance of vehicles. For this purpose, knowledge and skills are required to be imparted to them regarding automobile industry as a whole. This subject aims at developing required knowledge and skills in this area.

DETAILED CONTENTS

1. Introduction (04 hrs)

   1.1 Automobile and its development
   1.2 Various types of automobiles manufactured in India, their manufacturer and location of their manufacturing unit.
   1.3 Classification of automobiles
   1.4 Layout of chassis
   1.5 Types of drives-front wheel, rear wheel, four wheel.

2. Power System (08 hrs)

   2.1 Introduction, classification of I.C. engines.
   2.2 Engine terminology
   2.3 Fuel systems for petrol and diesel engines including multi point fuel injection (MPFI), common rail direct injection (CRDI), Fuel injectors and nozzles.
   2.4 Governing of fuel-carburettor, electronic control module (ECM i.e, 8 bit, 16 bit and 32 bit computers)
   2.5 Comparison of MPFI with carburettor system.
   2.6 Concept of double overhead cam, single overhead cam, Twin cam 16 valve technology in 4 cylinder engine.

3. Transmission System (10 hrs)

   3.1 Clutch - Function, Constructional details of single plate and multiplate friction clutches, Centrifugal and semi centrifugal clutch, Cone clutch, Hydraulic clutch
   3.2 Gear Box - Function, Working of sliding mesh, constant mesh and synchromesh gear box, Torque converter and overdrive,
   3.2 Propeller shaft and rear axle - Function, Universal joint, Differential, Different types of rear axles and rear axle drives.
   3.4 Wheels and Tyres - Types of wheels, Types and specifications of tyres used in Indian vehicles, Toe in, toe out, camber, caster, kingpin inclination, Wheel balancing and alignment

4. Steering System (08 hrs)

Function and principle, Ackerman and Davis steering gears, Types of steering gears - worm and nut, worn and wheel, worm and roller, rack and pinion, Power steering

5. Braking system (08 hrs)

Constructional details and working of mechanical, hydraulic, air and vacuum brake, Details of master cylinder, wheel cylinder, Concept of brake drum, brake lining and brake adjustment, Introduction to Anti lock brake system and its working.

6. Suspension System (08 hrs)

Function, Types, Working of coil spring, leaf spring, Air suspension, Shock absorber – Telescopic type and pneumatic type

7. Battery (06 hrs)

Constructional details of lead acid cell battery, Specific gravity of electrolyte - effect of temperature on specific gravity, Specification of battery-capacity, rating , number of plates, selection of battery for particular use, Battery charging, chemical reactions during charge and discharge, Maintenance of batteries, Checking of batteries for voltage and specific gravity

8. Dynamo and Alternator (08 hrs)

8.1 Dynamo - Function and details, Regulators - voltage current and compensated type, Cutout - construction, working and their adjustment,
8.2 Alternator - Construction and working, Charging of battery by alternator

9. Exhaust Emissions (04 hrs)

Types and use of catalytic converters, emission norm standards i.e. Euro I, Euro II, Euro III and Euro IV

LIST OF PRACTICALS

1 Fault and their remedies in (i) Battery Ignition system (ii) magnetic Ignition system.
2 Demonstration of (i) Head Light Model (ii) Wiper and Indicators.
3 Demonstration of (i) AC Pump (ii) SU Pump (iii) Master Cylinders.
4 Demonstration of (i) rear axle (ii) differential (iii) steering system.

5 Fault finding practices on an automobile - four wheelers (petrol/ diesel vehicles).

6 Tuning of an automobile engine.
7 Driving practice on a 4-wheeler.
8 Charging of an automobile battery and measuring cell voltage and specific gravity of electrolyte.
9 Changing of wheels and inflation of tyres, balancing of wheels.
10 Measuring spark gap, valve clearance and ring clearance; carrying out cleaning operations for adjustment.
11 Cleaning and adjusting a carburetor.

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. Automobile Engineering by GBS Narang; Khanna Publishers, Delhi.
2. Automobile Engineering by Dr. Kirpal Singh; Standard Publishers and Distributors, Delhi.
3. Automotive Mechanics, by W.Crouse and Anglin; Tata McGraw Hill, Delhi.
4. Automobile Engineering by G. S. Aulakh; Eagle Prakashan, Jalandhar

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	**Time Allotted (Hrs)**	**Marks Allotted (%)**
1	04	06
2	08	12
3	10	18
4	08	12
5	08	12
6	08	12
7	06	10
8	08	12
9	04	06
Total	**64**	**100**

6.4 MACHINE DESIGN

L	T	P
4	-	-

RATIONALE

A diploma holder in this course is required to assist in the Design and Development of Prototype and other components. For this, it is essential that he is made conversant with the principles related to design of components and machine and application of these principles for designing. The aim of the subject is to develop knowledge and skills about various aspects related to design of machine components.

DETAILED CONTENTS

1. Introduction (08 hrs)

   1.1 Design – Definition, Type of design, necessity of design

      1.1.1 Comparison of designed and undesigned work
      1.1.2 Design procedure
      1.1.3 Characteristics of a good designer

   1.2 Design terminology: stress, strain, factor of safety, factors affecting factor of safety, stress concentration, methods to reduce stress concentration, fatigue, endurance limit.

      1.2.1 General design consideration
      1.2.2. Codes and Standards (BIS standards)

   1.3 Engineering materials and their mechanical properties :

      1.3.1 Properties of engineering materials: elasticity, plasticity, malleability, ductility, toughness, hardness and resilience. Fatigue, creep, tenacity, strength
      1.3.2 Selection of materials, criterion of material selection

2. Design Failure (04 hrs)

   2.1 Various design failures-maximum stress theory, maximum strain theory
   2.2 Classification of loads
   2.3 Design under tensile, compressive and torsional loads.

3. Design of Shaft (10 hrs**)**

   3.1 Type of shaft, shaft materials, Type of loading on shaft, standard sizes of shaft available
   3.2 Shaft subjected to torsion only, determination of shaft diameter (hollow and solid shaft) on the basis of :
      - Strength criterion

- Rigidity criterion

3.3 Determination of shaft dia (hollow and solid shaft) subjected to bending

3.4 Determination of shaft dia (hollow and solid shaft) subjected to combined torsion and bending .

4. Design of Key (06 hrs)

4.1 Types of key, materials of key, functions of key

4.2 Failure of key (by Shearing and Crushing).

4.3 Design of key (Determination of key dimension)

4.4 Effect of keyway on shaft strength. (Figures and problems).

5. Design of Joints (20 hrs)

Types of joints - Temporary and permanent joints, utility of various joints

5.1 Temporary Joint:

5.1.1 Knuckle Joints – Different parts of the joint, material used for the joint, type of knuckle Joint, design of the knuckle joint. (Figures and problems).

5.1.2 Cotter Joint – Different parts of the spigot and socket joints, Design of spigot and socket joint.

5.2 Permanent Joint:

5.2.1 Welded Joint - Welding symbols. Type of welded joint, strength of parallel and transverse fillet welds.

5.2.2 Strength of combined parallel and transverse weld.

5.2.3 Riveted Joints. : Rivet materials, Rivet heads, leak proofing of riveted joint – caulking and fullering.

5.2.4 Different modes of rivet joint failure.

5.2.5 Design of riveted joint – Lap and butt, single and multi riveted joint.

6. Design of Flange Coupling (08 hrs)

Necessity of a coupling, advantages of a coupling, types of couplings, design of muff coupling, design of flange coupling. (both protected type and unprotected type).

7. Design of Screwed Joints (08 hrs)

7.1 Introduction, Advantages and Disadvantages of screw joints, location of screw joints.

7.2 Important terms used in screw threads, designation of screw threads

7.3 Initial stresses due to screw up forces, stresses due to combined forces

7.4 Design of power screws (Press, screw jack, screw clamp)

Note : The paper setter should provide all the relevant data for the machine design numericals in the question paper.

INSTRUCTIONAL STRATEGY

1. Use moulds of various parts/components.
2. Presentation should be arranged for various topics.

RECOMMENDED BOOKS

1. Machine Design by R.S. Khurmi and JK Gupta, Eurasia Publishing House (Pvt.) Limited, New Delhi.
2. Machine Design by V.B.Bhandari, Tata McGraw Hill, New Delhi.
3. Engineering Design by George Dieter; Tata McGraw Hill Publishers, New Delhi.
4. Mechanical Engineering Design by Joseph Edward Shigley; McGraw Hill, Delhi.
5. Machine Design by Sharma and Agrawal; Katson Publishing House, Ludhiana.
6. Design Data Handbook by D.P. Mandali, SK Kataria and Sons, Delhi.
7. Machine Design by A.P.Verma; SK Kataria and Sons, Delhi
8. Machine Design by AR Gupta and BK Gupta ; Satya Parkashan, New Delhi.
9. Machine Design by G.S. Aulakh; Eagle Prakashan, Jalandhar

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	08	12
2	04	06
3	10	16
4	06	10
5	20	32
6	08	12
7	08	12
Total	**64**	**100**

6.5 CNC MACHINES AND AUTOMATION

L	T	P
3	-	3

RATIONALE

Diploma holders are required to supervise and handle specialized machines and equipment like CNC machines. For this purpose, knowledge and skills about NC machines, part programming in NC machines and tooling for CNC machines are required to be imparted for enabling them to perform above functions. This subject aims at development of knowledge and skills about CNC machines, tools, equipment and use of high tech machines for increased productivity and quality.

DETAILED CONTENTS

1. Introduction (10 hrs)

   Introduction to NC, CNC & DNC, their advantages, disadvantages and applications, Machine Control Unit, input devices, serial communication and Ethernet techniques, selection of components to be machined on CNC machines, Problems with conventional NC, New developments in NC, Axis identification, PLC Control and its components.

2. Construction and Tooling (08 Hrs)

   Design features, specification Chart of CNC machines, use of slideways, balls, rollers and coatings, motor and leadscrew, swarf removal, safety and guarding devices, various cutting tools for CNC machines, overview of tool holder, different pallet systems and automatic tool changer system, management of a tool room.

3. Part Programming (08 Hrs)

   Part programming and basic concepts of part programming, NC words, part programming formats, simple programming for rational components, part programming using conned cycles, subroutines and do loops, tool off sets, cutter radius compensation and wear compensation.

4. System Devices (12 Hrs)

   Actuators, Transducers and Sensors, Tachometer, LVDT, opto-interrupters, potentiometers for linear and angular position, encoder and decoder, axis drives, open loop system, close loop system.

5. Problems in CNC Machines (04 Hrs)

   Common problems in mechanical, electrical, pneumatic, electronic and PC components of NC machines, diagnostic study of common problems and remedies, use of on-time fault finding diagnosis tools in CNC machines.

6. Automation and NC system (06 Hrs)

Role of computer in automation, emerging trends in automation, automatic assembly, manufacture of magnetic tape, manufacture of printed circuit boards, manufacture of integrated Circuits, Overview of FMS, Group technology, CAD/CAM and CIM.

LIST OF PRACTICALS

1 Study the constructional details of CNC lathe.

2. Study the constructional details of CNC milling machine.

3. Study the constructional details and working of:

- Automatic tool changer and tool setter
- Multiple pallets
- Swarf removal
- Safety devices

4. Develop a part programme for following lathe operations and make the job on CNC lathe and CNC turning center.

- Plain turning and facing operations
- Taper turning operations
- Operation along contour using circular interpolation.

5. Develop a part programme for the following milling operations and make the job on CNC milling

- Plain milling
- Slot milling
- Contouring
- Pocket milling

6. Preparation of work instruction for machine operator

7. Preparation of preventive maintenance schedule for CNC machine.

8. Demonstration through industrial visit for awareness of actual working of FMS in production.

9. Use of software for turning operations on CNC turning center.

10. Use of software for milling operations on machine centres.

INSTRUCTIONAL STRATEGY

This is highly practice-based course. Efforts should be made to develop programming skills amongst the students. During practice work, it should be ensured that students get opportunity to individually perform practical tasks.

RECOMMENDED BOOKS

1. CNC Machines – Programming and Applications by M Adithan and BS Pabla; New Age International (P) Ltd., Delhi.
2. Computer Aided Manufacturing by Rao, Kundra and Tiwari; Tata Mc Graw Hill, New Delhi.
3. CNC Machine by Bharaj; Satya Publications, New Delhi.
4. CNC Machine & Automation by Ramandeep Singh; Eagle Prakashan, Jalandhar

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	10	20
2	08	16
3	08	16
4	12	26
5	04	10
6	06	12
Total	**48**	**100**

6.6 PROJECT WORK

L	T	P
-	-	12

RATIONALE

The practical training cum project work is intended to place students for project oriented practical training in actual work situations for the stipulated period with a view to:

i) Develop understanding regarding the size and scale of operations and nature of field work in which students are going to play their role after completing the courses of study.

ii) Develop understanding of subject based knowledge given in the class room in the context of its application at work places.

iii) Develop first hand experience and confidence amongst the students to enable them to use and apply polytechnic/institute based knowledge and skills to solve practical problems in the world of work.

iv) Develop special skills and abilities like interpersonal skills, communication skills, attitudes and values.

This practical training cum project work should not be considered as merely conventional industrial training in which students are sent at work places with minimal supervision. This experience is required to be planned and supervised on regular basis by the polytechnic faculty. For the fulfillment of above objectives, polytechnic may establish close linkage with 8-10 relevant organization for providing such an experience. It is necessary that each organisation is visited well in advance and activities to be performed by students are well defined. The chosen activities should be such which are of curricular interest to students and of professional value to industrial/field organisations. Each teacher is expected to supervise and guide 5-6 students.

Effort should be made to identify actual field problems as project work for the students. Project selected should not be too complex which is beyond the level of the students. The placement of the students for such a practical cum project work should match with the competency profile of students and the project work assigned to them. Students may be assessed both by industry and polytechnic faculty. The suggested performance criteria is given below :

(1) Punctuality and regularity
(2) Initiative in learning/working at site
(3) Level/proficiency of practical skills acquired
(4) Ability of solve live practical problems
(5) Sense of responsibility
(6) Self expression/communication skills
(7) Interpersonal skills/Human Relation
(8) Report Writing Skills
(9) Viva Voce

The projects given to students should be such for which some one is waiting for solution. Some of the suggested project activities are given below:

1. Projects connected with repair and maintenance of machines .
2. Estimating and costing projects.
3. Design of jigs / fixtures.
4. Projects related to quality control.
5. Project work related to increasing productivity.
6. Projects relating to installation, calibration and testing of machines.
7. Projects related to wastage reduction.
8. Project, related to fabrication.
9. Energy efficiency related projects.
10. Projects related to improving an existing system

Note: 1. Students are required to prepare working drawings of the projects and will prepare the estimate, material lists as required, and carry out market survey etc.
2. Students will specify various processes involved in the project