

6.1 CNC MACHINES

L	T	P	Cr
3	-	4	5

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 (6 hrs)
 - Basic concepts of NC, CNC & DNC, adoption controls.
 - Advantages & Disadvantage of CNC Machines.
 - Application of CNC Machines.
 - Difference between conventional & CNC Machines.
 - Profitable applications of CNC Machines.

2. Construction of CNC Machines (12 hrs)
 - Machine control unit.
 - NC control.
 - PLC control, its advantages & disadvantages.
 - Application and limitations of PLC machines.
 - Axis designate of CNC machines.
 - Special constructional requirement of CNC machines.
 - Slide ways, bolt screw & nut assembly.
 - Lubrication & cooling of CNC machines.
 - Spindle & spindle motors, axis drives motor.
 - Swarf removal & safety provision of CNC machines.
 - Feedback mechanism in CNC machines.

3. Tooling of CNC Machines (8 hrs)
 - Introduction.
 - Various cutting tools for CNC machines.
 - Work holding devices.
 - Automatic tool changer.

4. Control System (8 hrs)
 - Open & close loop control system
 - Fundamental problem in control: Accuracy, resolution, repeatability, instability, response & damping,

- Type of position control:
 - i) Point to point
 - ii) Straight line
 - iii) Continuous

5. Part Programming (8 hrs)

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

6. Common Problems in CNC Machines (6 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

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.
 - Automatic tool changer and tool setter
 - Multiple pallets
 - Swarf removal system
 - 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 (internal and external)
 - Thread cutting operations (internal and external)
 - Operation along contour using circular interpolation
5. Develop a part programme for the following milling operations and make the job on CNC milling and CNC machining centre (vertical and horizontal type).
 - 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 of FMS on prototype model and industrial visit for awareness of actual working in production.
9. Use of software for turning operations on CNC turning center.
10. Use of software for milling operations on machine centres.

Note: For CNC programming, software such as MasterCAM/DelCAM/VeriCut may be used.

INSTRUCTIONAL STRATEGY

This is a 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 McGraw Hill, New Delhi.
3. Numerical Control of Machines Tools by Yorem Korem and IB Uri, Khanna Publishers, New Delhi.
4. Mechatronics by HMT, Bangalore

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time allotted (Hrs)	Marks Allotted (%)
1	6	12
2	12	25
3	8	16
4	8	16
5	8	16
6	6	15
Total	48	100

6.2 INDUSTRIAL MANAGEMENT AND ENTREPRENEURSHIP DEVELOPMENT

L	T	P	Cr
4	-	-	4

RATIONALE

The knowledge of this subject is required for all engineers/technicians who wish to choose industry/field as their career. This course is designed to develop understanding of various functions of management, role of workers and engineers and providing knowledge about industrial and tax laws.

DETAILED CONTENTS

1. Principles of Management (12 hrs)
 - 1.1 Management, Different Functions: Planning, Organising, Leading, Controlling
 - 1.2 Organizational Structure, Types, Functions of different departments
 - 1.3 Motivation: Factors, characteristics, methods of improving motivation, incentives, pay, promotion, rewards, job satisfaction, job enrichment
 - 1.4 Need for leadership, Functions of a leader, Factors for accomplishing effective leadership, Manager as a leader, promoting team work
 - 1.5 Introduction to operations management and MIS

2. Human Resources Development (03hrs)
 - 2.1 Introduction, objectives and functions of human resource development (HRD) department.
 - 2.2 Recruitment, methods of selection, training strategies and career development

3. Wages and Incentives (03 hrs)
 - 3.1 Definition and factors affecting wages, methods of wage payment.
 - 3.2 Wage incentive – type of incentive, difference in wage, incentive and bonus; incentives to supervisor.
 - 3.3 Job evaluation and merit rating.

4. Human and Industrial Relations (06 hrs)
 - 4.1 Human relations and performance in organization
 - 4.2 Understand self and others for effective behaviour
 - 4.3 Behaviour modification techniques
 - 4.4 Industrial relations and disputes
 - 4.5 Relations with subordinates, peers and superiors
 - 4.6 Characteristics of group behaviour and trade unionism
 - 4.7 Mob psychology
 - 4.8 Grievance, Handling of grievances
 - 4.9 Agitations, strikes, Lockouts, Picketing and Gherao
 - 4.10 Labour welfare schemes
 - 4.11 Workers' participation in management

5. Professional Ethics (03 hrs)
 - 5.1 Concept of professional ethics
 - 5.2 Need for code of professional ethics
 - 5.3 Professional bodies and their role

6. Sales and Marketing management (08 hrs)
 - 6.1 Functions and duties of sales department
 - 6.2 Sales forecasting, sales promotion, advertisement and after sale services.
 - 6.3 Concept of Marketing.
 - 6.4 Problems of Marketing.
 - 6.5 Pricing policy, break even analysis
 - 6.6 Distribution channels and methods of marketing.

7. Labour Legislation Acts (as Ammended on date) (06 hrs)
 - 7.1 Factory Act 1948.
 - 7.2 Workmen's Compensation Act 1923.
 - 7.3 Apprentices Act 1961.
 - 7.4 PF Act, ESI Act

- 7.5 Industrial Dispute Act 1947
- 7.6 Employers State Insurance Act 1948
- 7.7 Payment of Wages Act, 1936
- 8. Entrepreneurship Development (06 hrs)
 - 8.1 Concept of entrepreneur and need of entrepreneurship in the context of prevailing employment conditions
 - 8.2 Distinction between an entrepreneur and a manager.
 - 8.3 Project identification and selection.
 - 8.4 Project formulation.
 - 8.5 Project appraisal.
 - 8.6 Facilities and incentives to an entrepreneur
- 9. Environmental Engineering (05 hrs)
 - 9.1 Ecology
 - 9.2 Factory causing pollution
 - 9.3 Effects of pollution on Human health
 - 9.4 Air pollution and control
 - 9.5 Water pollution and control
 - 9.6 Solid waste management
 - 9.7 Noise pollution and its control
 - 9.8 Environmental protection Act at State and National level
- 10. Accidents and Safety (04 hrs)
 - 10.1 Classification of accidents based on nature of injuries, event and place.
 - 10.2 Causes and effects of accidents
 - 10.3 Accident-prone workers
 - 10.4 Action to be taken in case of accidents with machines, electric shock, fires and erection and construction accidents.
 - 10.5 Safety consciousness and publicity
 - 10.6 Safety procedures
 - 10.7 Safety measures - Do's and Don'ts and good housing keeping

11. Materials Management (4 hrs)
Inventory control models, ABC Analysis, Safety stock, Economic ordering quantity, Stores equipment, Stores records, purchasing procedures, Bin card, Cardex, Material handling techniques
12. Financial Management (4 hrs)
Importance of ledger and cash book, Profit and loss Account, Balance sheet, Interpretation of Statements, Project financing, Project appraisal, return on investments

RECOMMENDED BOOKS

1. Industrial Engineering and Management by O.P.Khanna; Dhanpat Rai and Sons, Delhi
2. Industrial Organization and Management by Tara Chand; Nem Chand and Brothers; Roorkee.
3. Marketing Management by Phillip Kotler; Prentice Hall of India, New Delhi
4. Environmental and Pollution Awareness by BR Sharma; Satya Prakashan, New Delhi.
5. Industrial Organisation and Engineering Economics by Banga and Sharma; Khanna Publishers, Delhi.
6. Industrial Management by C.L. Mahajan; Saluja Parkashan, New Delhi.
7. Management by Jams A Stoner, R Edward Freeman and Daniel R. Gilbrat, JR, Sixth Edition, Pearson Education, New Delhi
8. Industrial Management by VK Sharma, OP Harkut
9. Thakur Kailash, Environment Protection Law & Policy in India: Deep & Deep publication, New Delhi.
10. Handbook of Small Scale Industry by P.M. Bhandari.
11. Principles of Management by Philip Kotler, TEE Publication.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	12	20
2	3	5
3	3	5
4	6	10
5	3	5
6	8	12
7	6	10
8	6	10
9	5	8
10	4	5
11	4	5
12	4	5
Total	64	100

6.3 AUTOMOBILE ENGINEERING

L	T	P	Cr
4	-	2	5

RATIONALE

These days, automobiles have become a necessity instead of luxury. There has been phenomenal development of Automobile industry. The Diploma holders in Mechanical Engineering 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 (6 hrs)
 - Components of an automobile
 - Classification of automobiles
 - Layout of chassis
 - Types of drives-front wheel, rear wheel, four wheel, left hand, right hand

2. Transmission System (14 hrs)
 - Clutch Function, Constructional details and working of single plate and multiplate friction clutches, Centrifugal and semi centrifugal clutch
 - Gear Box – Function, construction and working of sliding mesh, constant mesh and synchromesh gear box, Torque converter and overdrive, fluid coupling
 - Function of Universal joint, propeller shaft, Function and construction of differential, Rear axle drives. Function of rear axle and different types of rear axles
 - Wheels and Tyres-Types of wheels - disc wheels and wire wheel, Types of tyres used in Indian vehicles, Toe in, toe out, camber, caster, kingpin inclination, Tubeless tyres

3. Steering System (8 hrs)
 - Function and principle
 - Ackerman and Davis steering gears

- Types of steering gears - worm and nut, worm and wheel, worm and roller, rack and pinion type
4. Braking system (6 hrs)
- Constructional details and working of mechanical, hydraulic and vacuum brake
 - Details of master cylinder, wheel cylinder
 - Concept of brake drum, brake lining and brake adjustment
5. Suspension System (6 hrs)
- Function
 - Types
 - Working of coil spring, leaf spring Shock absorber
 - Shock absorber
6. Battery (8 hrs)
- Constructional details of lead acid cell battery
 - Specific gravity of electrolyte - effect of temperatures on specific gravity
 - Capacity and efficiency of battery
 - Battery charging, chemical reactions during charge and discharge.
 - Maintenance of batteries
 - Checking of batteries for voltage and specific gravity
7. Dynamo and Alternator (8 hrs)
- Dynamo - Function and details, Regulators - voltage current and compensated type, Cutout - construction, working and their adjustment
 - Alternator-Construction and working, Charging of battery from alternator

- | | | |
|----|---|---------|
| 8. | Diagram of a Typical Wiring System | (4 hrs) |
| 9. | Lighting System and Accessories | (4 hrs) |
| | <ul style="list-style-type: none">▪ Lighting system▪ Wiring circuit▪ Headlight, aiming of headlights▪ Lighting switches▪ Direction indicators▪ Windscreen wiper▪ Horn▪ Speedometer▪ Heater▪ Air conditioning | |

LIST OF PRACTICALS

1. Fault and their remedies in (i) Battery Ignition system (ii) Magneto Ignition system
2. Study and sketch of (i) Head Light Model (ii) Wiper and Indicators
3. Study and sketch of (i) AC Pump (ii) SU Pump (iii) Master Cylinders
4. Study and sketch of (i) rear axle (ii) differential (iii) steering system
5. Fault finding practices on an automobile - four wheelers (petrol and diesel vehicles)
6. Assembly and disassembly of petrol and diesel engine of an automobile.
7. Tuning of an automobile engine.
8. Driving practice on a four wheeler.
9. Charging of an automobile battery and measuring cell voltage and specific gravity of electrolyte.
10. Phasing and calibration of fuel injection pump
11. Checking and adjusting clutch pedal play and brake pedal play, tightness of fan belt plate and brake shoe
12. Rotation of wheels and inflation of tyres, alignment of wheels

13. Measuring spark gap, valve clearance and ring clearance
14. Cleaning and adjusting a carburetor
15. Nozzle cleaning, testing and adjustment

RECOMMENDED BOOKS

1. Automobile Engineering Vol. I by Kirpal Singh; Standard Publishers, New Delhi
2. Automobile Engineering Vol. I by GBS Narang; Khanna Publishers, Delhi.
3. Automobile Engineering by RB Gupta; Satya Parkashan, New Delhi.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time allotted (Hrs)	Marks Allotted (%)
1	6	10
2	14	20
3	8	12
4	6	10
5	6	10
6	8	13
7	8	13
8	4	6
9	4	6
Total	64	100

6.4 MAINTENANCE ENGINEERING

L	T	P	Cr
3	-	4	5

RATIONALE

The diploma holders in Mechanical Engineering are required to maintain the machinery and plants, therefore, knowledge and skill in maintenance engineering is required to be imparted. Student has to understand the concept of testing, repair and maintenance and they should know the procedure for erection and commissioning of machines. They will come to know various lubrication system. The subject aims at developing required knowledge and skills in this area.

DETAILED CONTENTS

1. Maintenance (14 hrs)
 - 1.1 Definition, advantages, limitations and types of maintenance viz. preventive, breakdown, predictive, corrective
 - 1.2 Organization of maintenance
 - 1.3 Introduction to computerized maintenance record
 - 1.4 ISO standards for maintenance documentation
 - 1.5 Introduction to machine history card – purpose and advantages
 - 1.6 Preparation of yearly plan for preventive maintenance
 - 1.7 Need of frequently needed spare parts inventory
 - 1.8 Necessity and advantages of testing, repair and maintenance
 - 1.9 Economic aspects, manpower planning and material management

2. Erection and Commissioning of Machines (Installation) (6 hrs)
 - 2.1 Location, layout and positioning of machines
 - 2.2 Foundation – types of foundation, foundation plan, erection and leveling, grouting, vibration damping, vibration isolation – methods of isolation, anti vibration mounts.

3. Testing of Machines (6 hrs)
 - 3.1 Testing equipment – dial gauge, mandrel, spirit level, straight edge, auto collimator
 - 3.2 Testing methods – geometrical/alignment test, performance test, testing under load, run test, vibrations, noise

4. Lubrication Systems (8 hrs)
 - 4.1 Lubrication methods and periodical lubrication chart for various machines (daily, weekly, monthly)
 - 4.2 Handling and storage of lubricants
 - 4.3 Lubricants conditioning and disposal

- 4.4 Lubricant needed for specific components such as gears, bearings, and chains
- 4.5 Purpose and procedure of changing oil periodically (like gear box oil)
- 5. Repairing (6hrs)
 - 5.1 Common parts which are prone to failure, reasons of failure and remedial measures
 - 5.2 Maintenance schedule
 - 5.3 Parts that commonly need repair such as belts, couplings, nuts, and bolts
- 6. Storage of Parts (8 hrs)
 - 6.1 Storage of parts used frequently for replacement and parts which are not easily available in local market, storage of industrial fluids
 - 6.2 History cards of different machine parts
 - 6.3 Machines repair/replacement decision
 - 6.4 Introduction to 5-S practice, and FIFO practice (first In First Out)

LIST OF PRACTICALS

1. Preparation of prevention maintenance check.
2. Condition monitoring by non destructive testing.(NDT)
3. Project on maintenance of utility equipment like compressors, pumps, driers, valves (actuator type valves).
4. Equipment/machine leveling and alignment.
5. Maintenance of material handling equipment – pulley blocks, hand operated cranes, fork lifts, hydraulic jacks, mobile cranes, winches.
6. Use of lubrication equipment like oil gun, grease gun.
7. Removing old lubricant, cleaning and replenishing the machine with fresh lubricant.
8. Reconditioning of machine parts.
9. Replacing gear, bearing etc.

INSTRUCTIONAL STRATEGY

1. Lay greater emphasis on practical aspects of maintenance.
2. Make use of transparencies, video films and CD's.
3. Expose the students to real life situation.

4. Promote continued learning through properly planned assignments.
5. Demonstrate sample of all types of gear and bearings.

RECOMMENDED BOOKS

1. Industrial Maintenance by HP Garg; S. Chand and Company, Delhi.
2. Plant Maintenance Engineering by RK Jain; Khanna Publishers, Delhi.
3. Installation, Servicing and Maintenance by SN Bhattacharya; S Chand and Company, Delhi.
4. Maintenance Engineering and Management by RC Mishra and K Pathak; Prentice Hall of India Pvt. Ltd., New Delhi.
5. Installation, Maintenance, Servicing by AR Basu, M. Dutta & Co., Calcutta.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time allotted (Hrs)	Marks Allotted (%)
1	14	30
2	6	12
3	6	12
4	8	16
5	6	14
6	8	16
Total	48	100

6.5 PROJECT WORK

L	T	P	Cr
-	-	12	6

Project work aims at developing skills in the students whereby they apply the totality of knowledge and skills gained through the course in the solution of particular problem or undertaking a project. The students have various aptitudes and strengths. Project work, therefore, should match the strengths of students. For this purpose, students should be asked to identify the type of project work, they would like to execute. It is also essential that the faculty of the respective department may have a brainstorming session to identify suitable project assignments. The project assignment can be individual assignment or a group assignment. There should not be more than 3 students if the project work is given for a group. The students should identify or given project assignment at least two to three months in advance. The project work identified in collaboration with industry may be preferred.

Each teacher is expected to guide the project work of 5-6 students.

- Projects related to increasing productivity
- Projects related to quality assurance
- Projects related to estimation and economics of production
- Projects connected with repair and maintenance of plant and equipment
- Projects related to identification of raw material thereby reducing the wastage
- Any other related problems of interest of host industry

It is proposed that the institute may organize an annual exhibition of the project work done by the students and invite leading Industrial organisations in such an exhibition. It is also proposed that two students or two projects which are rated best be given merit certificate at the time of annual day of the institute. It would be better if specific industries are approached for instituting such awards.