BHAGWANT GLOBAL UNIVERSITY

KOTDWAR

STUDY AND EVALUATION SCHEME

&

SYLLABUS

DIPLOMA

MECHANICAL ENGINEERING

Bhagwant Global University, Kotdwar

STUDY AND EVALUATION SCHEME

Diploma Engineering 1st Year (Common to all Diploma Programmes)

(Effective from session:2017-18)

Year-I, Semester- I

Sr.No	Code	Subject	L	T	P	EVALUATION SCHEME				
			Periods/week			Internal Assessment (Sessional)		External Assessment (Examination)		Total Marks
						Theory	Practical	Written Paper	Practical	
						Max. Marks	Max. Marks	Max. Marks	Max. Marks	
1	01PME101	Applied Mathematics-I	3	1	0	40	-	60	-	100
2	01PME102	Applied Chemistry-I	3	0	0	40	-	60	-	100
3	01PME103	English and Communication skill-I	3	0	0	40	-	60	-	100
4	01PME104	Applied Physics-I	3	0	0	40	-	60	-	100
5	01PME105	Basics of Information Technology	3	0	0	40	-	60	-	100
6	01PME201	Applied Chemistry-I Lab	-	-	2	-	50	-	50	100
7	01PME202	English and Communication skill-I Lab	-	-	2	-	50	-	50	100
8	01PME203	Applied Physics-I Lab	-	-	2	-	50	-	50	100
9	01PME204	Basics of Information Technology	-	-	2	-	50	-	50	100
10	01PME205	Engineering Drawing-I Lab	-	-	2	-	50	-	50	100
11	01PME206	General Workshop Practice-I Lab	-	-	2	-	50	-	50	100
12	01PME207	Industrial Exposure (Assessment at Institute level)	-	-	1	-	50	-	-	50
13	01PME301	General Proficiency	-	-	-	-	50	-	-	50
Total										**1200**

Bhagwant Global University, Kotdwar

STUDY AND EVALUATION SCHEME

Diploma Engineering 1st Year (Common to all Diploma Prorammes)

(Effective from session:2017-18)

Year-I, Semester- II

Sr.No	Code	Subject	L	T	P	EVALUATION SCHEME				
			Periods/week			Internal Assessment (Sessional)		External Assessment (Examination)		Total Marks
						Theory	Practical	Written Paper	Practical	
						Max. Marks	Max. Marks	Max. Marks	Max. Marks	
1	02PME101	Applied Mathematics-II	3	1	0	40	-	60	-	100
2	02PME102	Applied Chemistry-II	3	0	0	40	-	60	-	100
3	02PME103	English and Communication skill-II	3	0	0	40	-	60	-	100
4	02PME104	Applied Physics-II	3	0	0	40	-	60	-	100
5	02PME105	Environmental Science	3	1	0	40	-	60	-	100
6	02PME201	Applied Chemistry-II Lab	-	-	2	-	50	-	50	100
7	02PME202	English and Communication skill-II Lab	-	-	2	-	50	-	50	100
8	02PME203	Applied Physics-II Lab	-	-	2	-	50	-	50	100
9	02PME204	Engineering Drawing-II Lab	-	-	2	-	50	-	50	100
10	02PME205	General Workshop Practice-II Lab	-	-	2	-	50	-	50	100
11	02PME206	Industrial Exposure (Assessment at Institute level)	-	-	1	-	50	-	-	50
12	02PME301	General Proficiency	-	-	-	-	50	-	-	50
Total										**1100**

Bhagwant Global University, Kotdwar

STUDY AND EVALUATION SCHEME

Diploma Engineering 2nd Year, Branch- Mechanical Engineering

(Effective from session:2017-18)

Year-II, Semester-III

Sr.No	Code	Subject	L	T	P	EVALUATION SCHEME				
			Periods/week			Internal Assessment (Sessional)		External Assessment (Examination)		Total Marks
						Theory	Practical	Written Paper	Practical	
						Max. Marks	Max. Marks	Max. Marks	Max. Marks	
1	03PME101	Applied Mechanics	3	1	0	40	-	60	-	100
2	03PME102	Material Science and Metallurgy	3	0	0	40	-	60	-	100
3	03PME103	Workshop Technology	3	0	0	40	-	60	-	100
4	03PME104	Machine Drawing	3	0	0	40	-	60	-	100
5	03PME105	Thermodynamics	3	1	0	40	-	60	-	100
6	03PME106	Basic Electrical and Electronics Technology	3	1	0	40	-	60	-	100
7	03PME201	Applied Mechanics Lab	-	-	2	-	50	-	50	100
8	03PME202	Material Science and Metallurgy Lab	-	-	2	-	25	-	25	50
9	03PME203	Workshop Technology Lab	-	-	2	-	50	-	50	100
10	03PME204	Machine Drawing Lab	-	-	2	-	50	-	50	100
11	03PME205	Thermodynamics Lab	-	-	2	-	25	-	25	50
12	03PME206	Basic Electrical and Electronics Technology Lab	-	-	2	-	50	-	50	100
13	03PME207	Industrial Exposure (Assessment at Institute level)	-	-	1	-	50	-	-	50
14	03PME301	General Proficiency	-	-	-	-	50	-	-	50
Total										**1200**

Bhagwant Global University, Kotdwar

STUDY AND EVALUATION SCHEME

Diploma Engineering 2nd Year, Branch- Mechanical Engineering

(Effective from session:2017-18)

Year-II, Semester-IV

Sr.No	Code	Subject	L	T	P	EVALUATION SCHEME				
			Periods/week			Internal Assessment (Sessional)		External Assessment (Examination)		Total Marks
						Theory	Practical	Written Paper	Practical	
						Max. Marks	Max. Marks	Max. Marks	Max. Marks	
1	04PME101	Strength of Materials	3	1	0	40	-	60	-	100
2	04PME102	Applied Thermal Engineering	3	1	0	40	-	60	-	100
3	04PME103	Basic Civil Engineering	3	0	0	40	-	60	-	100
4	04PME104	Production Technology	3	0	0	40	-	60	-	100
5	04PME105	Hydraulics and Hydraulic Machine	3	1	0	40	-	60	-	100
6	04PME106	Metrology	3	1	0	40	-	60	-	100
7	04PME201	Strength of Materials Lab	-	-	2	-	25	-	25	50
8	04PME202	Applied Thermal Engineering Lab	-	-	2	-	25	-	25	50
9	04PME203	Basic Civil Engineering Lab	-	-	2	-	25	-	25	50
10	04PME204	Production Technology Lab	-	-	2	-	50	-	50	100
11	04PME205	Hydraulics and Hydraulic Machine Lab	-	-	2	-	50	-	50	100
12	04PME206	Metrology Lab	-	-	2	-	25	-	25	50
13	04PME207	Industrial Exposure (Assessment at Institute level)	-	-	1	-	50	-	-	50
14	04PME301	General Proficiency	-	-	-	-	50	-	-	50
Total										**1100**

Training of 30 Days done after 4th semester would be evaluated in 5th semester through report and viva

Bhagwant Global University, Kotdwar

STUDY AND EVALUATION SCHEME

Diploma Engineering 3rd Year, Branch- Mechanical Engineering

(Effective from session:2017-18)

Year-III, Semester-V

Sr.No	Code	Subject	L	T	P	EVALUATION SCHEME				
			Periods/week			Internal Assessment (Sessional)		External Assessment (Examination)		Total Marks
						Theory	Practical	Written Paper	Practical	
						Max. Marks	Max. Marks	Max. Marks	Max. Marks	
1	05PME101	Computer Application in Mechanical drafting design & analysis	3	1	0	40	-	60	-	100
2	05PME102	Dynamics of Machine	3	1	0	40	-	60	-	100
3	05PME103	Machine Element Design	3	0	0	40	-	60	-	100
4	05PME104	Operation Management	3	0	0	40	-	60	-	100
5	05PME105	CNC Machines and Automation	3	1	0	40	-	60	-	100
6	05PME106	Maintenance Engineering	3	1	0	40	-	60	-	100
7	05PME201	Computer Application in Mechanical drafting design & analysis Lab	-	-	2	-	50	-	50	100
8	05PME202	CNC Machines and Automation Lab	-	-	2	-	50	-	50	100
9	05PME203	Maintenance Engineering Lab	-	-	2	-	50	-	50	100
10	05PME204	Industrial Training	-	-	2	-	100	-	-	100
11	05PME205	Industrial Exposure (Assessment at Institute level)	-	-	1	-	50	-	-	50
12	05PME301	General Proficiency	-	-	-	-	50	-	-	50
Total										**1100**

Bhagwant Global University, Kotdwar

STUDY AND EVALUATION SCHEME

Diploma Engineering 3rd Year, Branch- Mechanical Engineering

(Effective from session:2017-18)

Year-III, Semester-VI

Sr.No	Code	Subject	L	T	P	EVALUATION SCHEME				
			Periods/week			Internal Assessment (Sessional)		External Assessment (Examination)		Total Marks
						Theory	Practical	Written Paper	Practical	
						Max. Marks	Max. Marks	Max. Marks	Max. Marks	
1	06PME101	Entrepreneurship Development and Management	3	1	0	40	-	60	-	100
2	06PME102	Advance Machine Design	3	0	0	40	-	60	-	100
3	06PME103	Automobile Engineering	3	0	0	40	-	60	-	100
4	06PME104	Power Plant Engineering	3	0	0	40	-	60	-	100
5	06PME105	Mechatronics	3	1	0	40	-	60	-	100
6	06PME201	Automobile Engineering Lab	-	-	2	-	25	-	25	50
7	06PME202	Power Plant Engineering Lab	-	-	2	-	50	-	50	100
8	06PME203	Mechatronics Lab	-	-	2	-	25	-	25	50
9	06PME204	Project	-	-	2	-	75	-	75	150
10	06PME205	Industrial Exposure (Assessment at Institute level)	-	-	1	-	50	-	-	50
11	06PME206	Employable Skills	-	-	1	-	50	-	-	50
12	06PME301	General Proficiency	-	-	1	-	50	-	-	50
Total										**1000**

Bhagwant Global University

Kotdwar

Syllabus

Sr.No.	Semester I	Semester II	Semester III
1	Applied Mathematics-I-	Applied Mathematics-II	Applied Mechanics
2	Applied Chemistry-I	Applied Chemistry-II	Material Science and Metallurgy
3	English and Communication skill-I	English and Communication skill-II	Workshop Technology
4	Applied Physics-I	Applied Physics-II	Machine Drawing
5	Basics of Information Technology	Environmental Science	Thermodynamics
6	-	-	Basic Electrical and Electronics Technology

Sr.No.	Semester IV	Semester V	Semester VI
1	Strength of Materials	Computer Application in Mechanical drafting design & analysis	Entrepreneurship Development and Management
2	Applied Thermal Engineering	Dynamics of Machine	Advance Machine Design
3	Basic Civil Engineering	Machine Element Design	Automobile Engineering
4	Production Technology	Operation Management	Power Plant Engineering
5	Hydraulics and Hydraulic Machine	CNC Machines and Automation	Mechatronics
6	Metrology	Maintenance Engineering	-

APPLIED MATHEMATICS – I

Unit-1

Algebra:

1. Series: A.P. and G.P., nth term of AP and GP, , sum to nth term, Value of ${}^{n}p_{r}$ and ${}^{n}c_{r}$.
2. Binomial theorem (without proof) for positive integral index (expansion and general form); binomial theorem for any index (expansion without proof)
3. Partial fractions (linear factors, repeated linear factors, non-reducible quadratic factors only)
4. Determinants and Matrices – expansion of determinants (upto third order), properties of determinants, solution of equations (up to 3 unknowns) by Cramer's rule. Definition of matrix, addition, subtraction, multiplication of matrices (up to third order), minors and co-factors, inverse of a matrix by adjoint method (up to second order), Scalar and vector product of two /three vectors.

Unit-2

Trigonometry: Review of ratios of some standard angles (0,30,45,60,90 degrees), T-Ratios of Allied angles (without proof), Sum, difference formulae and their applications (without proof). Product formulae (Transformation of product to sum, difference and vice versa). T- Ratios of multiple angles, sub-multiple angles (2A, 3A,A/2).

Unit-3

Complex numbers: Definition of complex numbers, real and imaginary parts of a complex number, polar and Cartesian form and their inter-conversion, conjugate of a complex number, modulus and argument of a complex number, addition, subtraction, multiplication and division of a complex number. De-Moiver's Theorem (simple problems).

Unit-4

Co-ordinate Geometry:

1. Equation of straight line in various standard forms (without proof), inter section of two straight lines, angle between two lines, perpendicular distance formula (without proof)
2. General equation of a circle and its characteristics. To find the equation of a circle, given:
   * Centre and radius
   * Three points lying onit
   * Coordinates of end points of adiameter
3. Equations of conics (ellipse, parabola and hyperbola), simple problems related to engineering (standards forms only)

Recommended Books:

1. *Applied Mathematics by Dr. RD Sharma, Dhanpat Rai Publications,Delhi*
2. *Applied Mathematics-I (Hindi) by Dr. Kailash Sinha, Nav Bharat Publication,Meerut.*
3. *Applied Mathematics, Vol. I & II by SS Sabharwal and Sunita Jain, Eagle Parkashan, Jalandhar*

APPLIED CHEMISTRY –I

Course Objective:

The role of Chemistry and chemical products in every branch of engineering is expanding greatly. Now a day's various products of chemical industries are playing important role in the field of engineering with increasing number of such products each successive years. The strength of materials, the chemical composition of substances, their behavior when subjected to different treatment and environment, and the laws of heat and dynamic energy have entered in almost every activity of modern life. Chemistry is considered as one of the core subjects for diploma students in engineering and technology for developing in them scientific temper and appreciation of chemical properties of materials, which they have to handle in their professional career. Effort should be made to teach this subject through demonstration and with the active involvement of students.

Unit-1

Basics Concepts: Definition of chemistry and its importance, Definition of matter, element, compound and mixtures, atom, molecule, ion, symbol, formula, valency and chemical equation, Writing of the chemical formula of a simple chemical compound, Calculation of percentage composition of a chemical compound and form the empirical and molecular formula of the compound, Essentials of a chemical equation, balancing of a chemical equation by hit and trial method.

Unit-2

Atomic Structure and Chemical Bonding: Fundamental particles i.e. electron, proton and neutron, their characteristics (discovery is not included), Electronic concept of valency, Elementary account of electrovalent, covalent and coordinate bond formation on the basis of the electronic concept of valency giving suitable examples to each, Hydrogen bonding and its effect on physical properties of thecompounds, Electronic configuration of elements (up to Z = 30) with special reference to Aufbau principle.

Unit-3

Water:

1. Hardands of water,types of hardness and its causes,disadvantages of hardness of water
   (i) in industrial use (ii) in boilers for steam generation with special reference to sludge and scale formation; foaming and priming inboilers
2. Methods to remove hardness of water (i) Clark's Process (ii) Permutit Process (iii) Soda Lime process (iv) Ion-Exchange resin process. Simple numerical problems related to soda lime process.
3. Definition of degree of hardness of water and the systems to express the degree of hardness of water. Simple numerical problems related to finding the degree of hardness ondifferentscales.EstimationofhardnessofwatersamplebyO'Hehner'sMethodand
   E.D.T.A. Method
4. Qualities of water used for drinking purposes, treatment of river water to

make it fit for town supply

5. Disinfection of water by chlorination process

Unit-4
Solutions:

1. Concept of homogenous solution, brief introduction of the terms (i) Ionization (ii) Acidity (iii) Basicity (iv) equivalent weight and gram equivalent weight with suitable examples
2. Strength of a solution (i) Normality (ii) Molarity (iii) Molality as applied in relation to a solution with simple numerical problems related to theseterms
3. Definition of pH, and different industrial applications of pH, determination of pH of a solution with the help of pH meter including simple numerical problems.

Unit-5
Electrolysis:

1. Definition of the terms: Electrolytes, Non-electrolytes conductors and non-conductors with suitable examples
2. Faraday's Laws of Electrolysis with simple numerical problems
3. Different industrial applications of 'Electrolysis' with special reference to electroplating and electrorefining ofmetals
4. Basic concept of Buffer solutions, indicators and solubility product.

Unit-6
Environmental Chemistry:

1. General concept of pollution and pollutants
2. Types and control of pollution like air, water, noise and soil pollution
3. General idea of ozone depletion, global warming

LIST OF PRACTICALS

1. Volumetric analysis and study of apparatus used therein. Simple problems on volumetric analysis equation
2. Preparation of standard solution of oxalic acid or potassiumdichromate
3. To analyse the inorganic mixture for two acidic and two basic radicals from the following radicals
   a) Acidic Radicals CO_3^{--}, SO_4^{--}, NO_3^{-}, $CH\ COO^{-}$, Cl^{-}, Br^{-},I^{-}
   b) Basic Radicals NH_4^{++}, Pb^{+}, Cu^{++}, Cd^{++}, As^{+++}, Sb^{+++}, Sn^{++}, Al^{+++}, Fe^{+++}, Cr^{+++}, Mn^{++}, Ni^{++}, Co^{++}, Zn^{++}, Ba^{++}, Sn^{++}, Ca^{++} andMg^{++},
4. Determine the degree of temporary hardness of water by O'Heher'smethod
5. Estimation of total alkalinity of watervolumetrically
6. Determine pH of a given sample by using pHmeter
7. Determination of solubility of a solid at roomtemperature
8. Demonstration – Application of $FeCl_3$ in etching process for designing circuits on PCB (Printed Circuit Board)

Recommended Books:

1. *Chemistry in Engineering by J.C. Kuriacose and J. Rajaram; Tata McGraw-Hill Publishing Company Limited, New Delhi*
2. *A Text Book of Applied Chemistry-I by SS Kumar; Tata McGraw Hill,Delhi*
3. *A Text Book of Applied Chemistry-I by Sharma and Others; Technical Bureau of India, Jalandhar*
4. *Progressive Applied Chemistry –I and II by Dr. G.H. Hugar; Eagle Prakashan,Jalandhar*

ENGLISH AND COMMUNICATION SKILLS –I

Course Objective:

Interpersonal communication is a natural and necessary part of organizational life. Yet, communicating effectively can be challenging because of our inherent nature to assume, overreact to and misperceive what actually is happening. Poor communication or lack of communication is often cited as the cause of conflict and poor teamwork. In today's teamoriented workplace, managing communication and developing strategies for creating shared meaning are crucial to achieve results and create successful organizations. The goal of the Communicating Skills course is to produce civic-minded, competent communicators. To that end, students must demonstrate oral as well as written communication proficiency. These include organizational and interpersonal communication, public address and performance. The objectives of this subject are understanding how communication works, gaining active listening and responding skills, understanding the importance of body language, acquiring different strategies of reading texts and increasing confidence by providing opportunities for oral and written expressions.

Unit-1

Communication Skills: Introduction and Process of Communication, Objectives of Communication, Verbal and Non-verbal Communication, Process of Communication, Barriers to Communication, Overcoming Strategies, Listening and Speaking Skills and Sub-Skills (All topics should be in detail).

Grammar and Usage: Syntax (Parts ofspeech)

Unit-2

Writing Skills: Writing Paragraphs, PictureComposition, Developing writing skills based on some audio-visualstimulus

Reading Comprehension Skills: Unseen comprehension passages (at least 3 passages of literary, scientific, data interpretation).

Unit-3

Facets of Literature:

Friction: Homecoming – R.N.Tagore, The Selfish Giant - OscarWilde, The Missing Mail – R Klaxman

Prose: Of Studies – Francis Bacon, Art of Conversation – RichardSteel, Democracy – Dr.Radhakrishnan

Poems: Ozymandias – P.B.Shelley, Daffodils – WilliamWordsworth, Stopping by Woods on a Snowy Evening – RobertFrost

LIST OF PRACTICALS

(Note: The following contents are only for practice. They should not be included in the final theory examination)

DEVELOPING ORAL COMMUNICATION SKILLS

- Greeting, Starting aConversation
- Introducing Oneself

- Introducing Others
- Leave Taking
- Thanking, Wishing Well
- Talking about Oneself
- Talking about Likes and Dislikes
- Mock Interview

LIST OF REFERENCE BOOKS

1. *Communicating Effectively in English, Book-I by Revathi Srinivas; Abhishek Publications, Chandigarh.*
2. *High School English Grammar and Composition by Wren and Martin; S. Chand & Company Ltd.,Delhi.*
3. *Communication Techniques and Skills by R. K. Chadha; Dhanpat Rai Publications, New Delhi.*

APPLIED PHYSICS –I

Course Objective:

Applied physics includes the study of a large number of diverse topics all related to things that go on in the world around us. It aims to give an understanding of this world both by observation and by prediction of the way in which objects will behave. Concrete use of physical principles and analysis in various fields of engineering and technology are given prominence in the course content.

Unit-1

Units and Dimensions:

1. Physical quantities
2. Units - fundamental and derived units, systems of units (FPS, CGS, MKS and SI units)
3. Dimensions and dimensional formulae of physical quantities
4. Dimensional equations and principle of homogeneity, applications to conversion from one system of units to another, checking the correctness of physical relations and derivation of simple physical relations, limitations of dimensional analysis
5. Error in measurement, random and systematic errors, types of errors, propagation of errors, significantfigures

Unit-2

Force and Motion:

1. Concept of Scalar and Vector quantities – examples, types ofvectors.
2. Resolution and Composition of vectors, Vector multiplication (scalar product and vector product of vectors), addition of vectors (Parallelogram law)
3. Force: Newton's laws of motion, linear momentum and conservation of linear momentum, impulse and its application, simple numerical problem in brake system of vehicles and trainsetc.
4. Friction: Types of friction and its application
5. Circular motion: Angular displacement, angular velocity and angular acceleration
6. Relation between linear and angular variables (velocity and acceleration)
7. Centripetal force (derivation) and centrifugal force with application such as banking of roads and bending ofcyclists
8. Application of various forces inlifts

Unit-3

Rotational Motion:

1. Concept of translatory and rotating motion withexamples
2. Definitions of torque, angular momentum and theirrelationship
3. Conservation of angular momentum (qualitative) and itsexamples
4. Moment of inertia and its physical significance, radius of

gyration, Theorems of parallel and perpendicular axes (statements), Moment of inertia of rod, disc, ring and sphere (Formulaeonly).

5. Application of rotational motions in transport vehicles, trains and aero plane turbine/engine.

Unit-4

Work, Power and Energy:

1. Work: definition and its SIunits
2. Work done in moving an object on horizontal and inclined plane (incorporating frictional forces) with itsapplication
3. Power: definition and its SI units, calculation of power with numerical problems
4. Energy: Definition and its SI units: Kinetic energy and Potential energy with examples and theirderivation
5. Principle of conservation of mechanical energy (for freely falling bodies), transformation of energy from one form to another with its
its application.

Unit-5

Properties of Matter:

1. Elasticity: definition of stress and strain, different types of modulus of elasticity, stress – strain diagram, Hooke's law with its applications
2. Pressure: definition, its units, atmospheric pressure, gauge pressure, absolute pressure, Fortin's Barometer and itsapplications
3. Surface tension: concept, its units, angle of contact, measurement ofsurface tension by capillary tube method, applications of surface tension, effect of temperature and impurity on surfacetension
4. Viscosity and coefficient of viscosity: Stoke's Law and derivation of terminal velocity, effect of temperature on viscosity.

Unit-6

Thermometry

1. Difference between heat and temperature
2. Principles of measurement of temperature and different scales of temperature and their relationship
3. Types of thermometers (Conceptonly)
4. Expansion of solids, liquids and gases, coefficient of linear, surface and cubical expansions and relation amongstthem
5. Modes of transfer of heat (Conduction, convection and radiation with examples)
6. Co-efficient of thermalconductivity
7. Engineering Application of conduction, convection and radiations

Unit-7

Waves and Vibrations

1. Simple Harmonic Motion(SHM): definition, expression for displacement, velocity, acceleration, time period, frequency in S.H.M. Equation of simple harmonic progressive wave
2. Wave motion: transverse and longitudinal wave motion with examples, sound and light waves, velocity, frequency and wave length of a wave (relationship $v = n\lambda$) and their applications
3. Free, forced and resonant vibrations with examples
4. Acoustics of buildings – reverberation, reverberation time, echo, noise, coefficient of absorption of sound, methods to control reverberation time and their applications
5. Ultrasonics – production (magnetostriction and piezoelectric methods) and their engineering and medical applications

LIST OF PRACTICALS (to perform minimum ten experiments)

1. To find the diameter of wire using a screwgauge
2. To find volume of solid cylinder and hollow cylinder using a vernier calipers
3. To determine the thickness of glass strip and radius of curvature using a spherometer
4. To verify parallelogram law offorces
5. To find the time period of a simple pendulum and determine the length of second's pendulum.
6. To find the velocity of sound by using resonance apparatus at room temperature.
7. To determine the viscosity of glycerin by Stoke'smethod
8. To determine the coefficient of friction on horizontal plane.
9. To determine the Young';s Modulus by Searlesapparatus
10. To determine force Constant of spring using Hooke's Law

RECOMMENDED BOOKS

1. *Text Book of Physics for Class XI (Part-I, Part-II)N.C.E.R.T*
2. *Text Book of Physics for Class XII (Part-I, Part-II)N.C.E.R.T*
3. *Applied Physics Vol. I and Vol. II, TTTI Publications, Tata McGraw Hill, New Delhi*
4. *Concepts in Physics by HC Verma, Vol. I & II, Bharti Bhawan Ltd.*

NewDelhi

5. *Berkeley Physics Course, Vol. I, II &III, Tata McGraw Hill,Delhi*
6. *Comprehensive Practical Physics, Vol. I & II, JN Jaiswal, LaxmiPublishers*
7. *Engineering Physics by PV Naik, Pearson Education Pvt. Ltd, NewDelhi*
8. *Applied Physics I & II by RA Banwait & R Dogra, Eagle Parkashan,Jalandhar*
9. *Applied Physics by Jasmer Kaur and Bhupinder Singh, Lords Publications, Jalandhar.*

BASICS OF INFORMATION TECHNOLOGY

Course Objective:

Information technology has great influence on all aspects of life. Almost all work places and living environment are being computerized. In order to prepare diploma holders to work in these environments, it is essential that they are exposed to various aspects of information technology such as understanding the concept of information technology and its scope; operating a computer; use of various tools of MS office; using internet etc. form the broad competency profile of diploma holders. This exposure will enable the students to enter their professions with confidence, live in a harmonious way and contribute to the productivity.

1. Information Technology – its conceptandscope
2. Elements of a computer system, its usefulness and applications, block diagram of a computer, CPU, memory, data – numeric data, alpha numeric data; contents of a program, processing ofdata
3. Computer organization, computer hardware and software; primary and secondary memory: RAM, ROM, PROM etc.
4. Input devices; keyboard, scanner, mouse etc ; output devices ; VDU and Printer, Plotter
5. Primary and Secondary Storage (Auxiliary Storage), Secondary storage; magnetic disks – tracks and sectors, optical disk (CD, CD-RW and DVDMemory)
6. Introduction to Operating Systems such as MS-DOSandWindows
7. Introduction to internet, browsing using search engine (like google etc.
8. Basics of Networking – LAN,WAN,Topologies

LIST OF PRACTICALS

1. Given a PC, name its various components and list their functions
2. Identification of various parts of a computer and peripherals
3. Practice in installing a computer system by giving connection
4. DOS Commands (internal / external) e.g. TYPE, REN, DEL, CD, MD, COPY, TREE, BACKUP
5. Exercises on entering text and data (Typing Practice using anytutor)
6. Features of Windows as an operatingsystem.
7. To Study tha various features of MS-Word
8. To Study tha various features of MS-Excel
9. To Study tha various features MS PowerPoint
10. To Study Internet and its Applications

RECOMMENDED BOOKS:

2. *Fundamentals of Computer by V . Rajaraman; Prentice Hall of India Pvt. Ltd., New Delhi.*
3. *Computer Fundamentals by PK Sinha; BPB Publication, NewDelhi*
4. *Fundamentals of Information Technology by Leon and Leon;Vikas Publishing House*

ENGINEERING DRAWING-I

Course Objective:

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

1. Drawing Office Practice, Lines & Lettering (2 Sheets)

    1.1 Drawing instruments
    1.2 Sizes and layout of standard drawing sheets and drawingboards
    1.3 Different types of lines in engineering drawing as per BISspecifications
    1.4 Free hand lettering (alphabet and numerals) lower case and upper case,single stroke vertical and inclined at 75 degree in different standard series of 2.5, 3, 5, 7, 10, and 15 mm heights in the ratio of7:4

2. Dimensioning (2 Sheets)

    2.1 Necessity of dimensioning, Types of dimensioning (chain, parallel and progressive dimensioning, size and locationdimensioning)
    Methods of placing dimensioning (Aligned and unidirectional system), use of leader lines. General principles ofdimensioning.
    2.2 Dimensioning of overall sizes, circles, thread holes, chamfered surfaces, angles, tapered surface holes equally spaced on PCD, counter sunk hole counter bored holes, cylindrical parts, narrow space and gaps, radii, curves and arches.

3. Simple Geometrical Constructions used in Engineering Practice (2Sheets)

    3.1 Construction ofregularpolygons (triangle, square, pentagon, hexagon) and circles
    3.2 Ellipses (concentric circle method and Intersecting Arcsmethod)
    3.3 Parabola (rectangle and tangent method),cycloid

4. Scale (2 sheets)

    4.1 Scale – their need and importance, Definition of representative fraction (R.F), find RF of given scale
    4.2 Construction of plain and diagonalscales

5. Principle of Projections (7sheets)

    5.1 Principle of orthographic projection and introduction to first

angle projection and third angle projection

5.2 Projection of points situated in different quadrants (1Sheet)

5.3 Projection of lines, Lines inclined to one plane and parallel to the other and vice versa (1^{st}&3^{rd} quadrants); Line inclined to both reference planes (HP and VP)) (1 Sheet)

5.4 Projection of Planes: Planes perpendicular and parallel to either of the planes; planes perpendicular to one plane and inclined to the other or vice versa (1^{st}& 3^{rd} quadrants) (1Sheet)

5.5 Projection of solids, such as Prism, Cube, Cylinder and Cones with axis perpendicular to horizontal plane or parallel to horizontal plane/vertical plane or both

5.6 Drawing 3 orthographic views of given objects (3 sheets, at least one sheet in 3^{rd} Angle Projection)

5.7 Identification of surfaces on drawn orthographic views from isometric object drawn (1Sheet)

6. Sectional Views (1 sheet)

6.1 Need for sectional views –Drawing of different conventions for materials in sections, conventional breaks for shafts, pipes, rectangular, square, angle, channel and rolled sections

7. Isometric Views (2sheets)

7.1 Fundamentals of isometric projections (theoretical instructions) and isometricscales

7.2 Isometric views of combination of regular solids like cylinder, cone, cube, prism andpyramid

8. Symbols and Conventions (2sheets)

8.1 Civil engineering sanitary fittingsymbols

8.2 Electrical fitting symbols for domestic interior installations and electronics symbols

8.3 Building plan drawing with electrical and civil engineering symbols

RECOMMENDED BOOKS

1 Engineering Drawing by C M Verma, Takniki Parkashak,Roorkee.

2. Elementary Engineering Drawing (in First Angle Projection) by ND Bhatt, Charotar PublishingHouse

3. A Text Book of Engineering Drawing by Surjit Singh ; Dhanpat Rai and Co.,Delhi

4. Engineering Drawing by PS Gill ; SK Kataria and sons,Delhi

GENERAL WORKSHOP PRACTICE –I

Course Objective:

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

The following shops are included in the syllabus:

1. Carpentry and PaintingShop-1
2. FittingShop
3. WeldingShop-I
4. Electric Shop–I
5. Smithy Shop or Electronic Shop-I
6. Sheet Metal Shop

Note:

1. The branches e.g. Civil Engineering, Electrical Engineering and Automobile Engineering, will do **Smithy Shop** instead of Electronic Shop-I

2. The branches e.g. Electronics and Communication Engineering, Computer Engineering and Information Technology will do **Electronic Shop-I** instead of Smithy Shop

1. Carpentry and Painting Shop-I

1.1 Introductiontovarious types of wood such as Deodar, Kail, Partal, Teak, Mango, Sheesham, etc. (Demonstration and theiridentification).

1.2 Demonstration, function and use of commonly used hand tools. Care, maintenance of tools and safety measures to beobserved.

JobI Marking, sawing, planning and chiseling & their practice (size should bementioned)

1.3 Introduction to various types of wooden joints, their relative advantages and uses.

Job II Preparation of half lap joint

Job III Preparation of Mortise and Tenon Joint

1.4 Demonstration of various methods of painting wooden items.

Job IV Preparation of wooden surface before painting including primer coating Job V Painting Practice by brush/spray

Job VI Preparation of surface, before Painting such as cleaning, sanding,

putty. Procedure and application of primer code and painting steel items.

1.5 Safety precautions in carpentry shop

2. Fitting Shop

1. Introduction to fitting shop tools, common materials used in fitting shop, Identification of materials. Such as Steel, Brass, Copper, Aluminium etc. Identification of various sections of steel such as Flat, Angle, Tee, Channel, Bar Girder, Square, Z-Section,etc.
2. Description and demonstration of various types of work benches, holding devices and files. Precautions whilefiling.
3. Description and demonstration of simple operation of hack-sawing, demonstration and description of various types of blades and their specifications, uses and method of fitting theblade.

JobI Marking of job, use of marking tools and measuringinstruments.

JobII Filing a dimensioned rectangular or square piece of an accuracyof

r 0.5mm

Job III Filing practice (production of flat surfaces). Checking by straight edge.

Job IV Making a cutout from a square piece of MS Flat using hand hacksaw.

4. Care and maintenance of measuring tools like calipers, steel rule, try square, vernier calipers, micrometer, height gauge, combination set. Handling of measuring instruments, checking of zero error, finding of least count (all gauges including Dialgauge)

5. Welding Shop –I

5.1 (a) Introduction to welding and its importance in engineering practice; types of welding; common materials that can be welded, introduction to welding equipment e.g. a.c. welding set, d.c. rectifier, electrode holder, electrodes and their specifications, welding screens and other welding related equipment, accessories andgloves.

(b) Safety precautions duringwelding

(c) Hazards of welding and itsremedies

5.2 Electric arc welding, (a.c. and d.c.) precautions while using electric arc welding, Practice in setting current and voltage for striking proper arc. Earthing of weldingmachine.

JobI Practice of striking arc bending and tacking while using electric arc weldingset.

Job II Welding practice on electric arc welding for making uniform and straight weld beads

5.3 Various types of joints and endpreparation.

Job III Preparation of butt joint by electric arc welding.

Job IV Preparation of lap joint by electric arcwelding.

Job V Preparation of corner joint by using electric arc welding. Job VI Preparation of Tee joint by electric arc welding.

6. Electric Shop –I

6.1 Study, demonstration and identification of common electrical materials such as wires, cables, switches, fuses, ceiling roses, PVC Conduits, PVC Channels and allied items, tools along with electrical instruments such as voltmeter, ammeter andmultimeter.

6.2 Study of electrical safety measures and demonstration about use of protective devices such as fuses, MCBs, ELCBs and relays includingearthing.

Job I Identification of phase, neutral and earth of domestic appliances and their connection to two pin/three pin plugs.

Job II Preparation of a house wiring circuit on wooden board using fuse, switches, socket, holder, ceiling rose etc. in PVC conduit and PVC casing and capping wiring system.

6.3 Studyofcommonelectricalappliancessuchaselectriciron,electrickettle,
ceiling fan, table fan, electric mixer, electric Geyser, gas geyser, desert cooler, refrigerator, waterpurifier

6.4 Introduction to lead-acid battery, identification of parts and itsworking.

JobIII Installation of inverter with battery and to connect two or more batteries in series and in parallel (knowledge of a.c. and d.c.)

Job IV Charging of a battery and testing it with the help of hydrometer and celltester

7. Smithy Shop

7.1 Demonstration and detailed explanation of tools and equipment used. Forging operationsinsmithyshop.Safetymeasurestobeobservedinthesmithyshop.

7.2 Demonstration and description of bending operation, upsetting operation, description and specification of anvils, swage blocks, hammersetc.

7.3 Demonstration and description of tongs,

fullers, swages etc. JobI To forge aL-hook.

JobII To prepare a job involving upsetting process

JobIII To forge achisel

JobIV To prepare a cube from a M.S. round by forgingmethod.

5. Electronic Shop –I

5.1 Identification and familiarization with the following tools used in electronic shop: Such as Tweezers, Screw drivers (different sizes), Insulated Pliers, Cutter, Sniper, Philips Screw Driver (Star Screw Driver), L- Keys, Soldering Iron, soldering wire, flux . Their demonstration and uses.

5.2 Identification and familiarization with Multimeter (analog anddigital)

Job I Practice in the use of above mentioned tools and instruments. For this a small experimental set up may be done

5.3 Various types of protective devices such as : wire fuse, cartridge fuse etc.,

5.4 Identification and familiarization with ear phone speaker connector, telephone jacks and similar male and female connectors (audio,video)

5.5 Safety precautions to be observed in the electronicshop

5.6 Identification and familiarization with soldering and desolderingpractice

5.7 Introduction to thimbles and crimpingtools

NOTE: Demonstration boards for the electronics components such as resistor, capacitor, diodes, transistors, FETs, IFT Coils, ICs should bemade.

Job II Cut, strip, join an insulated wire with the help of soldering iron (repeat with different types ofwires)

Job III Cut, strip, connect/solder/crimp different kinds of wires/ cables (including co- axial and shielded cable) to different types of power/general purpose/audio video/telephone plugs, sockets, jacks, terminals, binding posts, terminal strips, connectors. The tasks should include making complete recording/ playback/ antenna/ speaker leads for common electronic products such as Radio, TV, CD players, VCD/DVD players, cassette recorder and players, Hi-Fi equipment, hand- set,microphone

6. Sheet Metal Shop

1. Introduction to sheet metal shop, use of hand tools and accessories e.g. different types of hammers, hard and soft mallet, sheet and wire gauge, necessary allowance required during job fabrication, selection of material andspecifications.

6.1 Introduction and demonstration of hand tools used in sheet metalshop.

6.2 Introduction and demonstration of various machines and equipment used in sheet metal shop e.g. shearing machine, bar folder, burring machine, power press, sheet bendingmachine.

6.3 Introduction and demonstration of various raw materials used in sheet metal shop e.g. M.S. sheet, galvanized-iron plain sheet, galvanised corrugated sheet, aluminium sheetsetc.

6.4 Study of various types of rivets, steel screwetc.

JobI Shearing practice on a sheet using handshears.

a) Practice on making single riveted lap joint/double riveted lap Joint.
b) Practice on making single cover plate chain type, seam joint and riveted buttjoint

Recommended Books:

1. *Workshop Technology I,II,III, by S K Hajra, Choudhary and A K Chaoudhary. Media Promoters and Publishers Pvt. Ltd.,Bombay*
2. *Workshop Technology by Manchanda Vol. I,II,III India Publishing House,Jalandhar.*
3. *Manual on Workshop Practice by K Venkata Reddy, KL Narayana et al; MacMillan India Ltd. NewDelhi*
4. *Basic Workshop Practice Manual by T Jeyapoovan; Vikas Publishing House (P) Ltd., NewDelhi*
5. *Workshop Technology by B.S. Raghuwanshi, Dhanpat Rai and Co., NewDelhi*

6. *Workshop Technology by HS Bawa, Tata McGraw Hill Publishers, NewDelhi*

APPLIED MATHEMATICS –II

Course Objective:

Applied Mathematics forms the backbone of engineering students. The curriculum of mathematics has undergone changes from time to time in accordance with growth of subject. Diploma in Engineering is a launching stage where the students learn the basics of engineering. The revised syllabus has been designed keeping in view the emerging needs of all categories of students. Great emphasis has been laid on application of various contents like differential calculus, integral calculus, differential equations and statistics. This course will develop analytical abilities to make exact calculations and provide continuing educational base to the students.

Unit-1:- Differential Calculus:

1. Definition of function, Concept of Limits.
2. Differentiation by definition of x^n , sin x, cos x, tan x, e^x, $\log_a x$only
3. Differentiation of sum, product and quotient of functions. Differentiation of function of a function.
4. Differentiation of inverse trigonometrical functions, Logarithmic differentiation, Exponential differentiation, Successive differentiation (upto third order only).
5. Applications:
    1. Maxima andminima
    2. Equation of tangent and normal to a curve (for explicit functions only) – Simple problems only

Unit-2:- Integral Calculus:

1. Integration as inverse operation of differentiation
2. Simple standard integrals and related problems
3. Simple integration by substitution, by parts and by partial fractions (for linear factors only)
4. Properties of definite integrals
5. Evaluation of definite integrals (simple problems)-

   Evaluation of $\int_0^{\pi/2} \sin^n x.dx$, $\int_0^{\pi/2} \cos^n x.dx$, $\int_0^{\pi/2} \sin^n x \cos^n x.dx$
   using formulae without proof (m and n being positive integers only)

6. Numerical integration by Simpson's Rule and Trapezoidal Rule (simple problems only)

Unit-3:- Ordinary Differential Equations:

1. Definition, order, degree, linear and non-linear differential

equations

2. Formation of differential equations (up to second order)
3. Solution of first order differential equations (a) Variable Separable (b) Homogeneous (c) Linear and (d)Exact.

Unit-4:- Statistics:

1. Measures of Central Tendency: Mean, Median,Mode
2. Measures of Dispersion: Mean deviation, Standard deviation
3. Co-efficient of rank correlation

RECOMMENDED BOOKS

1. *Applied Mathematics by Dr. RD Sharma, Dhanpat Rai Publications,Delhi*
2. *Applied Mathematics-I (Hindi) by Dr. Kailash Sinha, Nav Bharat Publication, Meerut.*
3. *Engineering Mathematics by Vol. I & II by S Kohli, IPH,Jalandhar*
4. *Applied Mathematics, Vol. I & II by SS Sabharwal & Sunita Jain, Eagle Parkashan, Jalandhar*

APPLIED CHEMISTRY-II

Course Objective:

The role of Chemistry and chemical products in every branch of engineering is expanding greatly. Now a days various products of chemical industries are playing important role in the field of engineering with increasing number of such products each successive years. The strength of materials, the chemical composition of substances, their behaviour when subjected to different treatment and environment, and the laws of heat and dynamic energy have entered in almost every activity of modern life. Chemistry is considered as one of the core subjects for diploma students in engineering and technology for developing in them scientific temper and appreciation of chemical properties of materials, which they have to handle in their professional career. Effort should be made to teach this subject through demonstration and with the active involvement of students.

Unit-1:- Metallurgy:

A brief introduction of the terms: Metallurgy, mineral, ore, gangue or matrix, flux, slag, concentration (methods of concentrating the ores), roasting calcination and refining as applied in relation to various metallurgicaloperations; Metallurgy of (i) Aluminium (ii)Iron; Definition of an alloy, purposes of alloying, composition and uses of alloys like magnalium, duralumin, alnico, invar and stainless steel.

Unit-2:- Fuels:

Definition of a 'Fuel', characteristics of a good fuel and classification of fuels with suitable examples; Definition of Calorific value of a fuel and its determination for a solid fuel with the help of Bomb calorimeter with simple numerical problems; Merits of gaseous fuels over those of other varieties of fuels; Manufacture,composition,properties and uses of (i) Water gas (ii) Oil gas (iii) Biogas (iv) Compressed Natural gas (CNG); Octane Number and CetaneNumber.

Unit-3:- Corrosion:

Meaning of the term 'corrosion' and its definition; Theories of corrosion i.e. (i) direct chemical action theory and (ii) electro chemicaltheory; Prevention of corrosion by Alloying, Providing metallic coatings and Sacrificial cathodic protections.

Unit-4:- Lubricants:

Definition of (i) lubricant (ii) lubrication; Classification of lubricants; Principles of lubrication- fluid filmlubrication and boundary lubrication; Characteristics of a lubricant such as viscosity, viscosity index, volatility, oxidation, oiliness, acidity, emulsification, flash point, fire point and pour point; Importance of additives inlubricants; Dewaxing and solvent refining of liquid lubricants.

Unit-5:- Cement and Glass:

General introduction to cement and glass; Manufacture of Cement; Manufacture of ordinary glass and lead glass.

Unit-6:- Classification and Nomenclature of Organic Compounds

Classification of Organic Compounds, functional group, Homologus Series; Physical and Chemical properties, and industrial use of Organic Compound; IUPAC system of nomenclature of Carboxylic acid, Alcohols, Phenols, Aldehydes, Ketones and Amines (first six members of each seriesonly).

LIST OF PRACTICALS

1. Gravimetric analysis and study of apparatus used therein
2. To determine the percentage composition of a mixture consisting of a volatile and a non-volatile substances
3. Estimate the amount of moisture in the given sample of coal
4. Esterification and ceric ammonium tests of alcohal
5. Sodium carbonate and Ester test of carboxylic acids
6. To determination the amount of copper in the given sample of copper sulphate with the help of N/20 sodium thiosulphate solution.
7. Detection of metal iron in the rust (solution of rust in concentrated HCL may be given)
8. Demonstration to determine calorific value of a solid fuel with the help of Bomb Calorimeter

RECOMMENDED BOOKS

1. *Chemistry in Engineering by J.C. Kuriacose and J. Rajaram; Tata McGraw-Hill Publishing Company Limited, NewDelhi*
2. *Engineering Chemistry by Dr. S. Rabindra and Prof. B.K. Mishra ; Kumar and Kumar Publishers (P) Ltd. Bangalore-40*
3. *A Text Book of Applied Chemistry-II by SS Kumar; Tata McGraw Hill,Delhi*
4. *A Text Book of Applied Chemistry-II by Sharma and Others; Technical Bureau of India, Jalandhar*
5. *Engineering Chemistry by Jain PC and JainM,*
6. *Chemistry of Engineering by AggarwalCV,*
7. *Chemistry for Environmental Engineers by SwayerandMcCarty,McGraw Hill, Delhi*
8. *Progressive Applied Chemistry –I and II by Dr. G.H. Hugar; Eagle Prakashan, Jalandhar*
9. *Applied Chemistry-II by Dr. J K Sharma, Abhishek Publications, Sector 17-C, Chandigarh.*

ENGLISH AND COMMUNICATION SKILL-II

Course Objective:

Interpersonal communication is a natural and necessary part of organizational life. Yet, communicating effectively can be challenging because of our inherent nature to assume, overreact to and misperceive what actually is happening. Poor communication or lack of communication is often cited as the cause of conflict and poor teamwork. In today's team oriented workplace, managing communication and developing strategies for creating shared meaning are crucial to achieve results and create successful organizations. The goal of the Communicating Skills course is to produce civic-minded, competent communicators. To that end, students must demonstrate oral as well as written communication proficiency. These include organizational and interpersonal communication, public address and performance. The objectives of this subject are understanding how communication works, gaining active listening and responding skills, understanding the importance of body language, acquiring different strategies of reading texts and increasing confidence by providing opportunities for oral and written expressions.

Unit-1:- Facets of Literature

Friction- The Portrait of a Lady - Khushwant Singh, The Doll's House – Katherine Mansfield, The Refugees – Pearl S. Buck.

Prose- Of Truth – Francis Bacon, Praises of Solitude – Samuel Johnson, A Gentleman – John Henry Newman.

Unit-2:-

Reading Skills- Unseen comprehension passages (at least 3 passages).

Writing Skills- Writing Notice, WritingCircular, Writing a Memo, Agenda for a Meeting, Minutes of theMeeting, Press release, Telephonic Messages, Paragraph writing: Simple and Current Topics should be covered.

Unit-3:- Correspondence

1. Business Letters
2. Personal Letters

Unit-4:- Communication

Media and Modes of Communication, Channels of Communication, Barriers to Communication, Listening Skills, Body language, Humour in Communication

LIST OF PRACTICALS

(Note: The following contents are only for practice. They should not be included in the final theory examination)

LISTENING COMPREHENSION

1. Locating Main Ideas in a ListeningExcerpt
2. Note-taking

DEVELOPING ORAL COMMUNICATIONSKILLS

1. Offering-Responding toOffers
2. Requesting-Responding to Requests
3. Congratulating
4. Expressing Sympathy andCondolences
5. ExpressingDisappointments
6. Asking Questions-PoliteResponses
7. Apologizing, Forgiving
8. Complaining
9. Persuading
10. Warning
11. Asking for and GivingInformation
12. GivingInstructions
13. Getting and Giving
14. Permission Asking For and Giving Opinions
15. Group Discussion

LIST OF REFERENCE BOOKS

1. *Communicating Effectively in English, Book-I by Revathi Srinivas; Abhishek Publications, Chandigarh.*
2. *High School English Grammar and Composition by Wren & Martin; S. Chand & Company Ltd., Delhi.*
3. *Communication Techniques and Skills by R. K. Chadha; Dhanpat Rai Publications, New Delhi.*

APPLIED PHYSICS-II

Course Objective:

Applied physics includes the study of a large number of diverse topics related to things that go in the world around us. It aims to give an understanding of this world both by observation and prediction of the way in which objects behave. Concrete use of physical principles and analysis in various fields of engineering and technology.

Unit-1:- Optics

1. Review of basic optics laws: reflection and refraction
2. Refraction and refractive index, image formation in lenses, image magnification, lens formulae (thin lens only), power of lens, total internal reflection and their applications
3. Simple and compound microscope, astronomical telescope, magnifying power and its calculation (in each case), Terrestrial and Galileo's telescope (Concept only) and their applications.

Unit-2:- Electrostatics

1. Coulombs law, unit of charge, electric potential and electric potential difference
2. Electric field, electric field intensity, electric lines of force, electric flux Gauss'sLaw
3. Applications of Gauss law in finding electric field of point charge, straight charged conductor, plane charged sheet and between two plane parallel chargedsheets
4. Capacitance, types of capacitors, capacitance of parallel plate capacitor, series and parallel combination of capacitors, Dielectric and its effect on capacitance, and dielectric breakdown
5. Application of electrostatics in electrostatic precipitator

Unit-3:- DC Circuits

1. Concept of electricity, current and its units, direct and alternating current, voltage, resistance and resistivity, potential difference and e.m.f., Concept and applications of potentiometer.
2. Ohm's law and its applications, concept of resistance, conductance, specific resistance, effect of temperature on resistance, co-efficient of resistance, series and parallel combination of resistors, introduction to superconductivity.
3. Kirchhoff's laws, Wheatstone bridge principle and its applications (Slide Wire Bridge)
4. Heating effect of current and concept of electric power, energy and their units, related numerical problems
5. Application of electricity in various equipments, advantages of electrical energy over other forms of energy

Unit-4:- Electromagnetism

1. Magnetic field and its units, magnetic intensity, magnetic lines of force, magnetic

flux and their units, Right hand thumb rule, magnetic lines of force due to straight conductor, circular coil and solenoid

2. Force on a charge, moving in a uniform magnetic field (Lorentz force). Force on a current carrying straight conductor. Torque on a current carrying rectangular coil.
3. Moving coil galvanometer conductor, its principle, construction and working, conversion of a galvanometer into ammeter and voltmeter.
4. Electromagnetic induction, Faradays Laws, Lenz'sLaw.
5. Applications of Electromagnetism

Unit-5:- Semiconductor physics

1. Energy bands, intrinsic and extrinsic semiconductors, p-n junction diode and its characteristics
2. Diode as rectifier – half wave and full wave rectifier, semiconductor transistor p-n-p and n-p-n (concept only)

Unit-6:- Modern Physics

1. Electro magnetic spectrum, photo electric effect and work function, X rays - properties, production and their applications in medicine andindustries.
2. Lasers: concept of energy levels, ionizations and excitation potentials; spontaneous and stimulated emission; lasers and its characteristics, population inversion, types of lasers, Helium- Neon and ruby lasers, their engineering and medical applications
3. Fibre optics: introduction to optical fiber materials, types, light propagation and applications in communication

LIST OF PRACTICALS (To perform minimum eight experiments)

1. Conversion of Galvanometer into an Ammeter of given range.
2. Conversion of Galvanometer into Voltmeter of given range.
3. To verify ohm's laws by drawing a graph between voltage and current.
4. To verify laws of resistances in series and in parallel connection.
5. To draw characteristics of a pn junction diode and determine

   knee and break down voltages
6. Verification of Kirchhoff'sLaws
7. Determination of resistivity by Wheatstone bridge
8. To determine the resistance of electronic components by multimeter
9. Determination of internal resistance of primary cell by using ammeter and voltmeter.
10. Todetermine emf of primary cell using potentiometer and standard voltage source.

RECOMMENDED BOOKS

1. Applied Physics I & II by RA Banwait & R Dogra, Eagle

Parkashan,Jalandhar

2. *Applied PhysicsVolIIbyJasmerKaurandBhupinderSingh,LordsPublications,Jalandhar*
3. *Basic Electronics and Linear Circuits by N N Bhargavaetal Tata Mc Graw Hill Publishers,New Delhi*
4. *Principles of Electronics by SK Sahdev, Dhanpat Rai and Co, NewDelhi*
5. *Engineering Physics by Vanchna Singh and Sheeetal Kumar, Cengage Learning India Pvt. Ltd. Patparganj,Delhi*
6. *Text Book of Physics for Class XI (Part-I, Part-II)N.C.E.R.T*
7. *Applied Physics, Vol. I and Vol. II, TTTI Publications, Tata McGraw Hill,Delhi*
8. *Concepts in Physics by HC Verma, Vol. I & II, Bharti Bhawan Ltd. NewDelhi*
9. *Fundamentals of Physics by Resnick, Halliday and Walker, Asian Book Pvt. Ltd., NewDelhi*
10. *Fundamentals of Optics by Francis A. Jenkins & Harvey E White, McGraw Hill International Editions, Physics Series*

ENVIRONMENTAL SCIENCE

Course Objective:

A diploma holder must have knowledge of different types of pollution caused due to industries and constructional activities so that he may help in balancing the eco system and controlling pollution by pollution control measures. He should also be aware of environmental laws related to the control of pollution.

Unit-1

Basics of ecology, eco system and sustainable development; Conservation of land reforms, preservation of species, prevention of advancement of deserts and lowering of water table.

Unit-2

Sources of pollution - natural and man made, their effects on living and non-living organisms, Pollution of water - causes, effects of domestic wastes and industrial effluent on living and non-living organisms, Pollution of air-causes and effects of man, animal, vegetation and non-living organisms, Sources of noise pollution and its effects

Unit-3

Solid waste management; classification of refuse material,types,sources and properties of solid wastes,abatement methods

Unit-4

1. Mining, blasting, deforestation and their effects
2. Legislation to control environment

Unit-5

1. Environmental Impact Assessment (EIA), Elements for preparing EIA statements
2. Current issues in environmental pollution and its control, role of non-conventionalsources of energy in environmental protection.

RECOMMENDED BOOKS

1. *Environmental and Pollution Awareness by Sharma BR; Satya Prakashan, NewDelhi.*
2. *Environmental Protection Lqw and Policy in India by Thakur Kailash; Deep and Deep Publications, NewDelhi.*

3. *Environmental Engineering and Management by Suresh K Dhamija; SK Kataria and Sons, NewDelhi.*
4. *Environmental Science by Deswal and Deswal; Dhanpat Rai and Co. (P) Ltd.Delhi.*

ENGINEERING DRAWING-II

Course Objective:

Drawing is said to be the language of engineers and technicians. Reading and interpreting engineering drawing is their day-to-day responsibility. The course is aimed at developing basic graphic skills so as to enable them to use these skills in preparation of engineering drawings, their reading and interpretation.

SECTION-A

1. **Section of Solids by Different Cutting Planes**
2. **Development of Surfaces (2sheets)**
   Development of surfaces – cubes, prisms, (square, pentagonal and hexagonal), cylinders, pyramids (square, pentagonal, hexagonal) and cones
3. **Detail and Assembly Drawing (2sheets)**
   1. Principle and utility of detail and assemblydrawing
   2. Wooden joints i.e. corner mortice and tenon joint, Tee halving joint, Mitre faced corner joint, Tee bridle joint, Crossed wooden joint, Cogged joint, Dovetail joint, Through Mortise and Tenonjoint
4. **Threads (2sheets)**
   a. Nomenclature of threads, types of threads (metric), single and multiple start threads
   b. Forms of various external thread sections such as V, square and acme threads, BA, BSW and Knuckle, Metric, Seller Thread, ButtressThreads
   c. Simplified conventions of left hand and right hand threads, both external and internalthreads
5. **Locking Devices (1sheet)**
   Lock nut, castle nut, split pin nut, sawn nut, slotted nut
6. **Nuts and Bolts (3sheets)**
   Different views of hexagonal and square nuts; Assembly of hexagonal headed, square headed, square headed with square neck, bolts with hexagonal and square nuts and washers. Foundations bolts – Rag bolt and Lewis bolt

SECTION-B

Screws, Studs and Washers (1sheet)

a. Drawing various types of machinescrews
b. Drawing various types of studs and setscrews

Keys and Cotters (2sheets)

1. Various types of keys and cotters and their practical application and preparation of drawing of various keys and cotters showing keys and cotters inposition
2. Cotter joints (i) gib and cotter joint (ii) knucklejoint

Rivets and Riveted Joints (2sheets)

1. Types of structural and general purposes rivet heads
2. Caulking and fullering of riveted joints
3. Types of riveted joints – lap, butt (single riveted, double riveted lap joint, single cover plate and double cover plate), chain and zig – zag riveting

Welded Joints (1sheet)

1. Various conventions and symbols of welded joints (IS696)
2. Practical applications of welded joints say joints on steel frames, windows, doors andfurniture

Couplings (2sheets)

1. Muff or Box coupling, half lap muffcoupling
2. Flange coupling (Protected andnon-protected)
3. Flexible coupling

AutoCAD (for practicals and viva only)

4. Practice on drawing commands, editingcommands
5. Practice on sectioning andhatching
6. Practice on preparing simpledrawings

RECOMMENDED BOOKS

1 *Engineering Drawing by C M Verma, TaknikiParkashak,Roorkee.*

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2 *Elementary Engineering Drawing by ND Bhatt, Charotar PublishingHouse*

3 *A Text Book of Engineering Drawing by Surjit Singh, Dhanpat Rai and Co.Delhi*

4 *Engineering Drawing by PS Gill, SK Kataria and Sons, NewDelhi*

5 *Machine Drawing by RB Gupta, Satya Prakashan, NewDelhi*

GENERAL WORKSHOP PRACTICE –II

Course Objective:

Psychomotor skills are mastered through practice, an opportunity therefore, has been extended to students through this course to refine their skills in different trades. The basic skills developed during first semester will be refined during this course by doing higher order skills jobs. In addition to developing general manual and machining skills in the students, the objective of development of sense of dignity of labour, precision, safety at work places, team working and right attitude among the students will also be met.

The following shops are included in the syllabus.

1. Carpentry and Paintingshop-II
2. Fitting and PlumbingShop
3. Welding shop-II
4. Electric shop-II
5. Electronic shop-II or MachineShop

Note:

1. The branches e.g. Civil Engineering, Mechanical Engineering, Mechanical (Automobile), Chemical Engineering, Chemical (R&P), Agriculture Engineering, Electrical Engineering and Automobile Engineering will do **MachineShop** insteadof Electronic shop-II
2. The branches e.g. Electronics and Communication Engineering, Computer Engineering and Information Technology will do **Electronic shop-II** instead of Machineshop.
3. The instructor is to first explain the introductory part given at the beginning under each shop followed by demonstration and practice bystudents.

Carpentry and Painting Shop-I

1. Introduction to joints, their relative advantages and uses.

JobI Preparationofdovetailjointandgluedjoint.

Job II Preparation of mitre joint

Job III Preparation of a lengthening Joint

Job IV Preparation of at least one utility job with and without lamination

2. Demonstration of job showing use of rip saw, bow saw and tenon saw, method of sharpening varioussaws.

3. Demonstration of job on band saw and circular saw, chain and chisel, universal wood working machine, Saw re-sharpening machine, saw brazing unit.
4. Importance and need of polishing wooden items. Introduction to polishing materials.
5. Job V Polishing on wooden items.

Fitting and PlumbingShop

1. Introduction to various types of threads (internal and external)-single start, multi-start, left hand and right handthreads.
2. Description and demonstration of various types of drills, taps and dies Selection of dies for threading, selection of drills, taps and reamers for tappingoperations.

   Job I Making internal and external threads on a job by tapping and dieing operations (manually)

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

   JobII Drilling practice on soft metals such as aluminum,brass and copper

   Job III Preparation of a job by filing on non- ferrous metal up to anaccuracy of ±0.2mm

   Job IV Preparation of job involving thread on GI pipe/ PVC pipe and fixing of different types of elbow ,tee ,union ,socket, stopcock, tapsetc.

Welding Shop –II

1. Introduction to gas welding, spot welding and seam welding and welding techniques. Adjustments of different types of flames in gas welding,demonstration and precautions about handling welding equipment.

Job I Practice in handling gas welding equipment (Low pressure and High pressure) and welding and tacking practice on simple jobs.

2. Common welding joints generally made by gas welding.
3. Job II Preparation of butt joint by gaswelding.

   Job III Preparation of small cot frame from conduit pipe by gas welding.

   JobIV Preparation of square pyramid from MS rods by welding (typeof welding to be decided by students themselves).

   Job V Exercise of preparing a job on spot/seam welding machine.

4. Demonstration and use of TIG and MIG welding equipment

Machine Shop

1. Introduction to various machines used

   in machine shop

2. Job I: Exercise on simpleturning

Job II: Exercise on taper turning

Job III:Marking an d drilling practice on mild steel piece Job

IV:Marking and drilling practice on aluminium piece

JobV:Demonstration of various functions of CNCMachine

RECOMMENDED BOOKS

1. *WorkshopTechnoogy by B.S.Raghuwanshi,Dhanpat Rai and Co.,NewDelhi*

APPLIED MECHANICS

Course Objective:

The subject Applied Mechanics deals with basic concepts of mechanics like laws of forces, moments, friction, centre of gravity, laws of motion and simple machines which are required by the students for further understanding of other allied subjects. The subject enhances the analytical ability of the students.

UNIT-1:- Introduction

Concept of engineering mechanics, definition of mechanics, statics, dynamics, application of engineering mechanics in practical fields. Definition of Applied Mechanics. Definition, basic quantities and derived quantities of basic units and derived units, Different systems of units (FPS, CGS, MKS and SI) and their conversion from one to another density, force, pressure, work, power, velocity, acceleration Concept of rigid body, scalar and vector quantities.

UNIT-2:- Laws of forces

Definition of force, measurement of force in SI units, its representation, types of force: Point force/concentrated force & Uniformly distributed force, effects of force, characteristics of a force, Different force systems (coplanar and non-coplanar), principle of transmissibility of forces, law of super-position, Composition and resolution of coplanar concurrent forces, resultant force, method of composition of forces, laws of forces, triangle law of forces, polygon law of forces - graphically, analytically, resolution of forces, resolving a force into two rectangular components, Free body diagram, Equilibrant force and its determination, Lami's theorem (concept only) *[Simple problems on above topics]*

UNIT-3:- Moment

Concept of moment, Moment of a force and units of moment, Varignon's theorem (definition only), Principle of moment and its applications (Levers – simple and compound, steel yard, safety valve, reaction atsupport), Parallel forces (like and unlike parallel force), calculating their resultant, Concept of couple, its properties and effects, General conditions of equilibrium of bodies under coplanar forces and beams, fixed support, roller, support, over hanging, Uniformly distributed load, point load, varying load, Position of resultant force by moment *[Simple problems on the above topics]*.

UNIT-4:- Friction

Definition and concept of friction, types of friction, force of friction, Laws of static friction, coefficient of friction, angle of friction, angle of repose, cone of friction, Equilibrium of a body lying on a horizontal plane, equilibrium of a body lying on a rough inclined plane, friction in simple screw jack, Calculation of least force required to maintain equilibrium of a body on a rough inclined plane subjected to a force:

a) Acting along the inclined plane Horizontally

b) At some angle with the inclined plane

[Simple problems on the above topics]

UNIT-5:- Centre of Gravity

Concept, definition of centroid of plain figures and centre of gravity of symmetrical solid bodies, Determination of centroid of plain and composite lamina using moment method only, centroid of bodies with removed portion. Determination of center of gravity of solid bodies - cone, cylinder, hemisphere and sphere; composite bodies and bodies with portion removed *[Simple problems on the above topics]*

UNIT-6:- Moment of Inertia

Concept of moment of inertia and second moment of area and radius of gyration, theorems of parallel and perpendicular axis, second moment of area of common geometrical sections: rectangle, triangle, circle *(without derivations).* Second moment of area for L, T and I sections, section modulus.

UNIT-7:- Simple Machines

Definition of effort, velocity ratio, mechanical advantage and efficiency of a machine and their relationship, law of machines , Simple and compound machine (Examples), Definition of ideal machine, reversible and self locking machine , Effort lost in friction, Load lost in friction, determination of maximum mechanical advantage and maximum efficiency, System of pulleys (first, second, third system of pulleys), determination of velocity ratio, mechanical advantage and efficiency. Working principle and application of wheel and axle, different pulley blocks, simple screw jack, worm and worm wheel, single and double winch crab. Expression for their velocity ratio and field of their application *[Simple problems on the above topics]*

LIST OF PRACTICALS

1. Verification of the following laws:

a) Parallelogram law of forces

b) Triangle law offorces

c) Polygon law offorces

2. To verify the forces in different members of jibcrane.
3. To verify the reaction at the supports of a simply supportedbeam.
4. To find the Mechanical Advantage, Velocity Ratio and efficiency in case of an inclinedplane.
5. To find the Mechanical Advantage, Velocity Ratio and efficiency of a screwjack.
6. To find the Mechanical Advantage, Velocity Ratio and efficiency of worm and wormwheel.
7. To find Mechanical Advantage, Velocity Ratio and efficiency of single purchasecrab.
8. To find out center of gravity of regularlamina.
9. To find out center of gravity of irregularlamina.
10. To determine coefficient of friction between three pairs of givensurface.

RECOMMENDED BOOKS

1. *A Text Book of Applied Mechanics by S Ramamurtham, Dhanpat Rai Publishing Co.Ltd.*
2. *A Text Book of Engineering Mechanics (Applied Mechanics) by RS Khurmi; S Chand and Co. Ltd., NewDelhi.*
3. *A Text Book of Applied Mechanics by RK Rajput; Laxmi Publications, NewDelhi*.

MATERIAL SCIENCE AND METALLURGY

Course Objective:

Materials play an important role in the construction and manufacturing of equipment/tools. Right selection of materials add to the economy, working and life of machinery. A diploma holder must be conversant with the properties, uses, availability and costs of materials used for construction/fabrication to enable him to perform his functions confidently. The subject of Engineering Materials has been designed to cover the above aspects.

UNIT-1:- Introduction

1. Classification: Metals and non-metals, Ferrous and non-ferrous metals and theiralloys.
2. Crystalline and non-crystalline structures; unit cells, Bravais space lattices, cubic closed pack structures, coordination number, miller indices, crystallographic planes anddirections.
3. Structural imperfections- point, line, planar and volume defects, structure propertyrelationship.
4. Names of common metals, their alloys and non-metals used inIndustry
5. Properties of metals andalloys
6. Physical properties - Appearance, luster, colour, density and meltingpoint\
7. Thermal and electrical conductivity
8. Corrosion, causes, effects andprevention.
9. Study of creep and fatigue.

UNIT-2:- Ferrous Metals and Alloys

1. Flow diagram for the production of ferrous metals from their ores, constituents of iron, iron carbon diagram.
2. Classification, composition and uses of cast iron and plain carbon steels. IS, BS and SAEGrades
3. Effect of alloying elements such as Aluminium, chromium, Nickel, Cobalt, Manganese, Molybdenum, tungsten, Vanadium, Silicon, Sulphur and Phosphorous onsteels.
4. Composition, properties, and uses of special steels such as High speed steel, Stainless steels, Silicon steels, Heat resistant steels, Springsteel.
5. Heat Treatment: Iron-carbon diagram, objectives of heat treatment. Brief description and uses with examples of principal heat treatment processes- Annealing, Normalizing, Tempering, Hardening, Carburising, Nitriding and Cyaniding and applications, case hardening.

UNIT-3

Iron Carbon Equilibrium Diagram- Phase transformation, Nucleation and growth

T-T-T Diagram- Importance of critical cooling rate, Martensite transformation, Nucleation and growth.

UNIT-4:- Non-ferrous Metalsand Alloys

1. Copper: Properties anduses
2. Composition, properties and uses of copper alloys.
3. Brasses: Cartridge brass, Nickelsilver
4. Bronzes: Phosphor bronze, Al-bronze, Mn-bronze, and Gunmetal.
5. Properties and uses ofAluminium.
6. Composition, properties and uses of Al-alloys e.g., Duralumin, Yellow metal, Magnalium and Hindalium
7. Properties and uses of alloys of lead, tin andmagnesium.
8. Bearing Metals: Requisite qualities. Composition, properties and uses of white metal bearing, copper based bearing metals. Aluminium based bearing metals. Use of nylon/PTFE for bushes/bearings, bi-metallic and trimetallicbushes.

UNIT-5:- Identification and Examination of Metals and Alloy

Microscope principle and methods, Identification tests - Appearance, sound, filing, weight, magnetic, spark, bend and microstructure.

UNIT-6:- Other Important Materials

1. Plastics: Definition, classification of plastics, fibre glass, reinforced plastics. Major applications of various plastics and their uses andgrades.
2. Compositematerials.
3. Heat insulating materials: Properties and uses of asbestos, glass wool, thermo Cole, cork,mica.
4. Electrical insulating materials. Properties and uses of china clay, leather, bakelite, ebonite, glass wool, rubber,felt.
5. Sound insulating materials: Cork, fibreboards.
6. Fabrication materials: Wood, plywood, rubber – natural and synthetic, Glass – plate glass, toughened glass, safetyglass.
7. Refractory materials: General characteristics and uses of dolomite,ceramics.
8. Protective coating materials: Paints, primers, varnishes, enamels, putti, electroplating materials, rubasil, Tefloncoating.
9. Sealant and adhesives – Application and availability of sealant and adhesives for industrial user.
10. Smartmaterials.

UNIT-7:

Diffusion- Ficks Laws of Diffusion and practical examples

Powder Metallurgy and Mechanical Working of Metals-

1. Introduction of powdermetallurgy
2. Advantage and limitations of powder metallurgy
3. Powder metallurgyprocesses
4. Principles of hot and coldworking

5. Effect on properties and limitations

UNIT-8:- Selection, specifications and commercial availability of materials

1. Practical considerations for selection of material for differentpurposes
2. ISO/Bureau of Indian standard specifications for metals, non-metals, various components and materials.

LIST OF PRACTICALS

1. Classification of about 25 specimen of materials
   - Metals and NonMetals
   - Metals andAlloys
   - Ferrous and non ferrousmetals
   - Ferrous and non ferrousalloys
2. Given a set of specimen of metals and alloys (copper, brass, aluminum, cast iron, HSS, Gun metal), identify and indicate the various properties possessed bythem
3. Study of heat treatment furnace
4. Study of metallurgical microscope and a specimen polishing machine.
5. To prepare specification of following materials for microscopic examination and to examine the micro structure of specimens of followingmaterials
   (i) Brass (ii) Copper (iii) Grey CI (iv) Malleable CI (v) Low carbon Steel (vi) High carbon steel

   (vii) HSS
6. To anneal a given specimen and find out difference in hardness as a result ofannealing
7. To normalize a given specimen and to find out the difference in hardness as a result of normalizing
8. To temper a given specimen to find out the difference in hardness as a result oftempering
9. Study of Ball Mills used in preparation of powder.
10. Study of Pallet Press.

RECOMMENDED BOOKS

1. Material Science by R.K.Rajput; Laxmi Publications, Darya Ganj, NewDelhi.
2. Advances in material Science by R.K.Dogra and Dr.A.K.Sharma;S.K.kataria & sons; NewDelhi.
3. Material Science by GBS Narang; Khanna Publishers NewDelhi
4. Material Science and Metallurgy by D.S. Nutt. SK Kataria and Sons,Delhi.
5. Material Science and Engineering by Dr. P.LShah

WORKSHOP TECHNOLOGY

Course Objective:

This subject provides knowledge about various welding processes and foundry work and machine work. Welding is very useful for fabrication work and foundry for production of castings used for manufacturing of machines and machine work is also use for manufacturing which is included in this subject and it is very essential for diploma holders.

UNIT-1

Principle of welding, Classification of welding processes, Advantages and limitations, Industrial applications of welding, Welding positions and techniques, symbols.

Gas Welding , Principle of gas welding, Types of gas welding flames and their applications, Gas welding equipments, Gas welding torch, Oxy acetylene cutting torch, Blow pipe, Pressure regulators, Filler rods and fluxes.

Arc Welding, Principle of operation, Arc welding machines and equipment, A.C. and D.C. arc welding, Effect of polarity, current regulation and voltage regulation, Electrodes, Flux for arc welding.

Other Welding processes, Resistance welding: Principle, advantages, limitations, working and applications of spot welding, seam welding, projection welding and percussion welding. Shielded metal arc welding, submerged arc welding, welding defects, methods of controlling welding defects and inspection of welded joints.

Modern Welding Methods, Principle of operation, advantages, disadvantages and applications of: Tungsten inert gas (TIG) welding, Metal inert gas (MIG) welding, Thermit welding, Electro slagwelding.

UNIT-2

Pattern Making, Types of pattern, Pattern material, Pattern allowances, Pattern codes as per B.I.S. Introduction to cores, core boxes and core materials, Core making procedure , Core prints, positioning of cores.

Moulding Sand , Properties of moulding sand, permeability, refractoriness, adhesiveness, cohesiveness, strength, flow ability, collapsibility etc. Various types of moulding sand and testing of moulding sand.

Mould Making, Types of moulds, Molding boxes, hand tools used for mould making, Molding processes: Bench molding, floormolding, pit molding and machinemolding.

Special Casting Processes Principle, working and applications of Die casting: hot chamber and cold chamber, Investment and lost wax process, Centrifugal casting, Continuous casting process

Gating and Risering system , Elements of gating system, Pouring basin, sprue, runner, gates Types of risers, location of risers.

Melting Furnaces Construction and working of: Pit furnace, Cupola furnace, Crucible furnace –tilting type.
Casting Defects, Different types of casting defects and their reasons, testing of defects: radiography, magnetic particle inspection, and ultrasonic inspection.

UNIT-3

Elementry theory of metal cutting, chip formation, continuous chip, continuous chip with BUE, discontinuous chips. Mechanism of chip formation, Geometry of chip formation, forces of chip, Merchant circle diagram. Tool life, Economics of tool life.

Cutting Tools and Materials, Various types of single point cutting tools and their uses, Single point cutting tool geometry, tool signature and its effect, Heat produced during cutting and its effect, Cutting speed, feed and depth of cut and their effect, Properties of cutting tool material, Study of various cutting tool materials viz. High speed steel, tungsten carbide, cobalt steel, cemented carbides, stellite, ceramics and diamond.

UNIT-4

Lathe, Principle, Description and function of various parts of a lathe , Classification and specification of various types of lathe, Drives and transmission, Work holding devices, Lathe tools: Parameters/Nomenclature and applications, Lathe operations :- Plain and step turning, facing, parting off, taper turning, eccentric turning, drilling, reaming, boring, threading and knurling. Cutting parameters –Speed, feed and depth of cut for various materials and for various operations, machining time. Speed ratio, preferred numbers of speed selection. Lathe accessories:- Centers, dogs, chucks, collets, face plate, angle plate, mandrel, steady rest, taper turning attachment, tool post grinder

UNIT-5

Drilling, Principle of drilling. Classification of drilling machines and their description. Various operations performed on drilling machine –drilling, spot facing, reaming, boring, counter boring, counter sinking, hole milling, tapping. Speeds and feed during drilling, machining time. Types of drills and their features, Types of reamers.

Boring Principle of boring, Classification of boring machines and their brief description. Specification of boringmachines.

Shaping, Planing and Slotting ,Working principle of shaper, planer and slotter. Quick return mechanism applied to shaper, slotter and planer machine. Types of

tools used and their geometry. Specification of shaper, planer and slotting machine. Speeds and feeds in aboveprocesses.

Cutting fluids and Lubricants, Function of cutting fluid ,Types of cutting fluids, Difference between cutting fluid and lubricant, Selection of cutting fluids for different materials and operations,Common methods of lubrication of machine tools.

PRACTICAL EXERCISES

1. Single point cutting tool grinding.
2. A composite job involving turning, taper turning, thread cutting and knurling.
3. Marking and drilling practice using column and knee type drilling machine and radial drilling machine.
4. A job on drilling, reaming, counter boring and counter sinking.
5. Prepare a V- block on shaper machine.
6. Exercise on key waycutting..
7. Preliminary joining practice by gas welding.
8. Exercises of gas welding on the following Aluminum, Brass, Copper,C.I.
9. Gas cutting of the following types

   (a) Preliminary gas cutting practice

   (b) Stock cutting by oxyacetylene
10. Making following types of joints by arc welding:

    (a) Preliminary joining practice by arc welding

    (b) Butt and lap joint (invertical position, travel up and down)

    (c) Welding of outside corner joint
11. Exercise on spot welding
12. Exercise on brazing
13. Exercise on TIG/MIGwelding
14. Testing & Inspection of welding defects visually
15. Pattern making: Preparation of solid pattern (single piece), Preparation of split pattern

16. Preparation of the following types of moulds. Floor molding.
17. Testing moisture content of moulding sand
18. Moulding and casting of (a) a solid pattern b) a split pattern
19. Testing and inspection of casting defects visually

RECOMMENDED BOOKS

1. *Welding Technology by R.L. Agarwal and Tahil Maghanani; Khanna Publishers,Delhi.*
2. *Principles of Foundry Technology by Jain; Tata Mc Graw Hill Publishers, NewDelhi.*
3. *Workshop Technology by B S Raghuvanshi; Dhanpat Rai and Sons,Delhi.*
4. *Manufactuiring Technolgoy by M Adithan and AB Gupta, New Age International (P) Ltd.,Delhi*

MACHINE DRAWING

Course Objective:

This subject provides knowledge about various welding processes and foundry work and machine work. Welding is very useful for fabrication work and foundry for production of castings used for manufacturing of machines and machine work is also use for manufacturing which is included in this subject and it is very essential for diploma holders.

UNIT-1:- Introduction to Machine Drawing

1. Graphic language, classification of machine drawing, conventional representation.
2. System of orthographic projections. Third angle projection, first angle Projection No. of views required. One view, Two views, Three views drawing
3. Sectioning- Material convention, important types of section- full section, half Section ,revolved section and aligned section
4. Temporary and permanent fasteners

UNIT-2

Bearings (3 sheets)- Bush bearing, Foot Step bearing, Simple wall bracket
Pulleys (2 sheets)- Flat belt pulley, V belt pulley, Cone or stepped pulley, Fast and loose pulley
Pipe Joints (4 sheets)- Flange joint, Spigot and socket joint, Threaded pipejoint, Expansion joint, Piping joint

UNIT-3

Assembling drawing from detail drawing (13 sheets)- Stuffing box, Eccentric, Blow off cock, Cross head, Connecting rod, Ram's bottom safety valve, Stop valve, Plummer block, Tail stock, Shaper tool head, Machine vice, Screw jack, Swivel Bearing.

UNIT-4

Gears and Gearing (2 sheets)-
Spur gear- Nomenclature, gear formula, method to draw base circle, involute curve, tooth profile of internal and external gears
Bevel gear- Nomenclature, gear formula, method to draw Bevel gear
Free hand sketches (2sheets)- Cutting tool of lathe, shaper, milling cutter, drilling tools, broaching tools; Gear puller, C clamp, Square and hexagonal nut bolt assembly, Cotter joint
Knuckle joint, Pipe joints.

UNIT-5

Jig, fixture and Gauges(2 sheets)-

1. Concept of jig and fixture, types of jig and fixture andapplications
2. Simple plate drill jig, drill jig for batchproduction
3. Indexingfixture
4. Introduction to gauges, use of Go-No Go gauge and ringgauge

RECOMMENDED BOOKS

1. *Machine Drawing by P.S. Gill; Kataria and Sons,Ludhiana.*
2. *A Text book of Machine Drawing by R.K. Dhawan , S.Chand and Company Ltd.,NewDelhi.*
3. *Machine Drawing by GR Nagpal; Khanna Publishers, NewDelhi.*
4. *Machine Drawing by ND Bhatt, Charotar Book Depot,Anand.*

THERMODYNAMICS

Course Objective:

Diploma holders are required to read and interpret drawings .Therefore, it is essential that they have competency in preparing drawings and in sketching various machine parts and this will also improve their imagination skill.

UNIT-1:- Fundamental Concepts

Introduction, thermodynamic system, surrounding, boundary, state, universe, thermodynamic systems– closed, open, isolated, adiabatic, homogeneous and heterogeneous, macroscopic and microscopic, properties of system – intensive and extensive, thermodynamic equilibrium, quasi – static process, reversible and irreversible processes, concept of work and heat, equality of temperature, Zeroth law of thermodynamics, definition of properties like pressure, volume, temperature, enthalpy, internal energy, Simple numerical problems.

UNIT-2:- Laws of Perfect Gases

Definition of gases, concept of perfect gas, explanation of perfect gas laws – Boyle's law, Charle's law, Avagadro's law, Regnault's law, Universal gas constant, Characteristic gasequations, derivation, (Simple numerical problems)Specific heat at constant pressure, specific heat at constant volume of gas, derivation of an expression for specific heats with characteristics, simple problems on gas equation.

UNIT-3:- Thermodynamic Processes on Gases

Types of thermodynamic processes – isochoric, isobaric, isothermal, hyperbolic, isentropic, polytropic and throttling processes, equations representing the processes Derivation of work done in various processes change in internal energy.

UNIT-4:-Laws of Thermodynamics

Law of conservation of energy, first law of thermodynamics (Joule'sexperiment), Application of first law of thermodynamics to non-flow systems –Constant volume, constant pressure, Adiabatic and polytropic processes, steadyflow energy equation, Application of steady flow energy equation to turbines, pump, boilers, compressors, nozzles, evaporators. Limitations. Heat source and heat sinks, statement of second laws of thermodynamics: Kelvin Planck's statement, Classius statement, equivalence of statements, Perpetual motion Machine of first and second kind, Carnot engine, concept of irreversibility, entropy, Introduction to third law of thermodynamics (Simple numerical problems)

UNIT-5:- Ideal and Real Gases

Concept of ideal gas, enthalpy and specific heat capacities of an ideal gas, P – V –T surface of an ideal gas, triple point, real gases, Vander-Wall's equation, Amagat's experiment, equation of states Mass fraction, mole fraction, partial pressure, introduction to compressibility of gases.

UNIT-6:- Properties of Steam

Formation of steam and related terms, thermodynamics properties of steam, steam tables, internal latent heat, internal energy of stream, entropy of water, entropy of steam, T- s diagrams, Mollier diagram (H – s Chart), Expansion of steam, Hyperbolic, reversible adiabatic and throttling processes Quality of steam (dryness fraction), measurement of dryness fraction, throttling calorimeter, separating and throttling calorimeter.

UNIT-7:- Steam Boiler

Type of steam Generators, Working principle of boilers, need of high pressure modern boilers, characteristics of modern boilers. Working principle of Sterling, La-mont, Loeffler, Benson, Velox, Ramsin and Schmidt- Hartmann boiler.

UNIT-8:- Steam turbines

-Function and use of steam turbine
-Steam nozzles- types and applications
-Steam turbines, impulse, reaction, simple and compound, construction and working principle
-Governing of steam turbines

UNIT-9:- Steam condensers

-Function of a steam condenser, elements of condensing plant
-Classification-Jet condenser, surface condenser
-Cooling pond and cooling towers

UNIT-10:- Air compressors

Function of air compressor, type of air compressor - single stage, multi stage reciprocating compressors, inter-cooling of compressors, rotary compressor, Construction and working.

LIST OF PRACTICLES

1. Demonstration of steam turbines through models andvisit
2. Demonstration of steam condensers through models andvisits
3. Study of modern high pressure steam boilers (at least one)
4. Demonstration of boiler Accessories and mounitings
5. Demonstration/ study of an impulse turbines
6. Demonstration/ study of a reaction turbine
7. Demonstration of air compressor

RECOMMENDED BOOKS

1. *Engineering Thermodynamics by PK Nag; Tata McGraw Hill,Delhi*
2. *Thermal Engineering byR.K.Rajput*
3. *Thermal Engineering byR.S.Khurmi*

BASIC ELECTRICAL AND ELECTRONICS TECHNOLOGY

Course Objective:

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.

UNIT-1:- Overview of Electricity

General use and applications of electricity; Use and applications of electricity to agriculture, Mechanical & Automobile sector; Advantages of electrical energy over other forms of energy.

UNIT-2:- DC Circuits

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.

UNIT-3:- AC Circuits

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.

UNIT-4:- Batteries and Solar Cells

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.

UNIT-5:- Electrical Machines

Electromagnetic induction; Introduction to magnetic circuits; Principles of electromechanical energy conversion; Construction and operation of single phase transformers; Tests of transformers; Efficiency and regulation; Operation of autotransformers & 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 inductionmotors.

UNIT-6:- Semiconductors

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.

UNIT-7:- Measuring Instrument

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).

UNIT-8:- Electrical Installation and Safety

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'sLaw
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 ofdirection
5. Connection of analog and digital single phase energymeter
6. Study of a distribution board for domestic and industrial installation
7. Open-circuit and short-circuit test on a single-phasetransformer
8. Star-delta starting of inductionmotors
9. To draw V-I characteristics of pn-junctiondiode
10. To draw input and output characteristics of a transistor in CB and CE configurations

RECOMMENDED BOOKS

1. *Electrical Machines by SK Bhattacharya; Tata McGraw Hill, NewDelhi*
2. *Basic Electrical Engineering by PS Dhongal; Tata McGraw Hill Publishers,New*

STRENGTH OF MATERIALS

Course Objective:

Diploma holders in this course are required to analyses reasons for failure of different components and select 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.

UNIT-1:- Introduction to Material Properties

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

UNIT-2:- Stresses and Strains

1. Force, its definition and types, units, different types ofloads.
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
3. Factor ofsafety.
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 loadonly
5. Stress and strain on composite section under axial loading, stress and strain due to temperature variations in homogeneous and compositebars.
6. Shear load, shear stress and strain, modulus of rigidity, lateral strain, Poisson'sratio
7. Volumetric strain, bulk modulus. Relation between modulus of elasticity, modulus of rigidity and bulkmodulus

UNIT-3:- Shear Force and Bending Moment

1. Types ofbeams.
2. Concept of shear force and bendingmomen.
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 ofcontraflexure.

UNIT-4:- Theory of Simple Bending

1. Concept of pure bending, neutral axis, moment of resistance, section Modulus, bending equation, bending of simple, beams of

uniformstrength.

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

UNIT-5:- Strain Energy

1. Concept of strain energy, proof resilience and modulus ofresilience.
2. Stresses developed due to gradual, sudden and impactload.
3. Strain energy stored due to gradual, sudden and impactload.
4. Strain energy due to bending andtorsion.

UNIT-6: -Slope and Deflection

1. Introduction, determination of slope and deflection by Macaulay's method, moment area ofmethod
2. Simple cases of slope and deflection in simply supported beam with uniformlydistributed load on whole of the length and a point load at thecentre
3. Cantilever beam with uniformly distributed load on whole length and a point load at the end.

UNIT-7:- Torsion

1. Pure torsion, torsion equation (relation between twisting moment, shear stress and angle of twist), polar modulus of section
2. Assumptions in theory of pure torsion
3. Strength of circular solid shaft and hollow shaft in pure torsion
4. Power transmitted byshaft

UNIT-8:- Springs

1. Effect of falling load helicalspring
2. Helical Springs closed coiled and open coiled helical springs subjected to axialload
3. Angle of twist, strain energy, shear stress and maximum deflection under axialload
4. Laminated spring (semi-elliptical and quarter-elliptical type), deterination of number of plates, maximum deflection under axialload

UNIT-9:- Thin Cylinder and spheres

1. Introduction
2. Thin cylinder Vessel Subjected to internal Pressure\
3. Stresses in a Thin cylinder Vessel Subjected to internal Pressure
4. Expression for circumferentialstresses\
5. Expression for longitudinalstresses\
6. Stresses in a Thin cylinder Vessel Subjected to internal Pressure and external pressure\
7. Stresses in a thin sphere shells subjected to internal Pressure

UNIT-9:- Riveted Joints

Introduction, Types of rivetsjoints, Failure of rivetedjoints,Strength of the riveted joints, Efficiency of riveted joints.

UNIT-10:-Columns and struts

1. Definition, Types ofcolumn
2. Buckling load, crushingload\
3. Slenderness ratio.
4. Factors affecting strength of column
5. Euler's formula for longcolumns
6. End restraints, effective length for different endconditions
7. Rankine Gourdanformula
8. Direct and eccentric loading with stressdiagram
9. Direct and bending stresses and theircombination

LIST OF PRACTICALS

1. Perform tensile test on bars of mild steel andaluminum.
2. Perform shear test on specimen of two differentmetals.
3. Carry out bending tests on a steel bar or woodenbeam.
4. Perform following impacttest:
   (a) Izod impacttest
   (b) Charpytest
5. Perform torsion test on specimen of different metals for determination of angle oftwist for a giventorque.
6. Determine the stiffness of a helical spring and to plot a graph between loadand extension.
7. Perform hardness test on metal and finding the Brinell hardness, Rockwell hardness and Vicker'shardness.

RECOMMENDED BOOKS

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

APPLIED THERMAL ENGINEERING

Course Objective:

Thermal energy is still a major means of power in the world. Knowledge of thermal contrivances and related principle is very essential for mechanical diploma holders. The subject presents an introduction to sources of heat, thermodynamics principles and their applications to thermal contrivances.

UNIT-1:- IC Engines

1. Introduction and classification of IC engine
2. Working principle of two stroke and four stroke cycle, SI engines and CI engines, Otto cycle, Diesel cycle and dualcycle
3. Location and functions of various parts of IC engines and materials used for them
4. Concept of IC engine terms: bore, stroke, dead centre, crankthrow, compression ratio, clearance volume, piston displacement and piston speed, working of carburettor, mixture requirements, carburetor types, simple numerical problems concerning the above.

UNIT-2:-

Cooling and Lubrication

1. Function of cooling system in Ic engine
2. Air cooling and water cooling system, use of thermostat, radiatorand forced circulation in water cooling (description with line diagram)

Testing of IC Engines

1. Engine power - indicated and brakepower
2. Efficiency - mechanical, thermal. relative andvolumetric
3. Methods of finding indicated and brake power, Morsetest.
4. Morse test for petro1engine
5. Heat balancesheet
6. Concept of pollutants in SI and CI engines, pollution control, norms for two or four wheelers - EURO standards, methods ofreducing pollution in IC engines, alternative fuels like CNG, LPG (Simple numerical problems)

UNIT-3:-

Fundamentals of Refrigeration

Introduction to refrigeration and air conditioning, units of refrigeration, meaning of refrigerating effect, compressor work, condenser work and COP, difference between COP and efficiency, methods of refrigeration, natural system and artificial system of refrigeration (Simple numerical problems)

Vapour Compression System

Principle, function, parts and necessity of vapour compression system, T- ϕ and p– H

charts, dry, wet and superheated compression. Sub cooling, super heating, mass flow rate, entropy, enthalpy, work done, refrigerating effect and COP.actual vapour compression system (Simple numericalproblems)

UNIT-4:-

Refrigerants

Functions, classification of refrigerants, properties of R - 717, R – 22, R–134 (a), CO2, R – 11, R – 12, R – 502, Properties of ideal refrigerant, selection of refrigerant.

Vapour Absorption System

Introduction, principle, NH3 absorption system, lithium bromide absorption system, domestic electrolux system, analysis of vapour absorption system, solar power refrigeration system, advantages and disadvantages of solar power refrigeration system over vapour compression refrigeration system (Simple numerical problems).

UNIT-5:- Refrigeration Equipment

1. Compressors- Function, various types of compressors, volumetric efficiency, power for single stage compressor, intermediate pressure for multistage compressor for maximum power, performance characteristics
2. Condensers- Function, various types of condensers, essential requirements of a condenser, water cooled and air cooled condensers, free and forced convection condensers, fouling factor, heat rejection factor, overall heat transfer coefficient
3. Evaporators- Function, DX and flooded evaporator, advantages and disadvantages, other types of evaporators
4. Expansion Valves-Function, various types such as capillary tube, thermostatic expansion valve, low side and high side float valves, application of various expansion valves

UNIT-6:- Air Conditioning

Psychrometry- Definition, importance, specific humidity, relative humidity, degree of saturation, DBT, WBT, DPT, humid heat, latent heat, relationship amongst them.

Applied Psychrometry and Heat Load Estimation- Psychrometric chart, various lines, psychrometric process, by pass factor, room sensible heat factor, effective room sensible heat factor, ADP, room DPT, supply air condition, different heat sources for calculation of heat load, factors which contribute towards load of an air conditioning room (Simple numerical problems)

LIST OF PRACTICALS

1. Study of working principle of two/ four stroke petrol engines.
2. Study of simple/ compound carburetor.
3. To determine brake horse power bydynamometer.
4. To determine indicated horse power of a multicylinder petrol/dieselengine.
5. To prepare that balance sheet of diesel/ petrolengines
6. To study a vapour compression/ absorption refrigerationsystem
7. Study a cold storage through avisit
8. Study a room air conditioner
9. Study of cooling system of I.C.engines

10. Study of lubrication system of four stroke I.C.engine

RECOMMENDED BOOK

1. *Elements of heat engines by Pandey and Shah; Charotar Publishinghouse, Anand*
2. *Thermal Engineering by PL.Ballaney; Khanna Publishers, NewDelhi.*
3. *Engineering Thermodynamics by Francis F Huang; McMillanPublishing company,Delhi.*
4. *Engineering Thermodynamics by CP Arora; Tata Mc Graw Hill Publishers,New Delhi.*
5. *Refrigeration and air conditioning by Domkundwar; Dhanpat Rai & sons,Delhi.*
6. *Refrigeration and air conditioning by CP Arora , Tata McGraw Hill , NewDelhi.*
7. *Refrigeration and air conditioning by R.S Khurmi and J.K Gupta; S Chandand Company Limited, NewDelhi*

BASIC CIVIL ENGINEERING

UNIT-1:-Construction Material

Basics of various construction materials such as stones,bricks,lime,cement,steel and timber along with their properties, physical/field testing and uses, elements of brick and stone masonry.

UNIT-2:-

Foundations Engineering- Various types of soil, Bearing capacity of soil and itsimportance,Types of various foundations for heavy, light and vibrating machines.
Basic concept ofconcrete- Various ingredients of concrete, physical properties of aggregate as constituent material of concrete, different grade of concrete, water cement ratio, workability, physical/field testing of concrete, mixing of concrete , Introduction to IS: 456-2000, IS: 800-2007 and NBC 2005 (SP-7: 2005)

UNIT-3:- RCC

Basics of reinforced cement concrete and its use (elementary knowledge), introduction to various structural elements of a building, design of plain concrete strap footing.
Steel structure- Various types of steel, various rolled steel sections and their properties, use of steel table, introduction to riveted andweldedconnections.

UNIT-4:- Environmental engineering

Various sources of water, parameters related to qualities of portable water, impurities in water, introduction to various methods of water treatment.

UNIT-5:- Surveying

Introduction to surveying, representation to scale, introduction to chain surveying, traversing and plain table surveying , introduction to leveling , introduction to contouring and its properties.

LIST OF PRACTICALS

1. **Testing of bricks:**
   (a) Shape & Size
   (b) Soundness Test
   (c) Water Absorption
   (d) Crushing Strength

2. **Testing of Concrete:**
   (a) SlumpTest
   (b) Compressive Strength of concrete cube.
3. **Testing of Aggregates:**
   (a) Impact Test
   (b) AbrasionTest
4. **Testing of Sand:**
   (a) Field test of physical impurities of sand
5. **Testing on Steel:**
   (a) Tensile Strength Test of steel bars
6. **SurveyingTest:**
   (a) Ranging withrod
   (b) Determination of reduced level (R.L.) of a point using DumpyLevel.
   (c) Measurement of bearings & internal angles of a traverse using PrismaticCompass.
7. The students should be taken to different construction sites to sho them various construction materials, concreting process & construction of RCC structural elements, foundations & other civil works.

REFERENCES

1- ***BuildingMaterials***
   (a) S.K. Duggal: Building Materials, New Age InternationalPublishers
   (b) P.C. Varghese: Building Materials,PHI
2- ***FoundationEngineering***
   (a) Gopal Ranjan & Rao, A.S.R., "Basics of Applied Soil Mechanics", New Age International Publishers.
   (b) B. C. Punmia, "Soil Mechanics & Foundations", LaxmiPublications
3- ***Basics concept ofConcrete***
   (a) M. S. Shetty " Concrete Technology": S ChandPublication
   (b) Neville A.M.,: "Properties of Concrete", Pitman PublishingCompany
4- ***Reinforced CementConcrete***
(a) A.K. Jain, " Reinfored Concrete", Nem Chand &Bros
(b) O.P. Jain & J. Krishna, " Plain & Reinforcement Concrete", Nem Chand &Bros
5- ***Steel Structures***
   (a) S.K. Duggal, "Steel Structures",TMH
   (b) S.S. Bhavikatti, "Steel Structures", I.K. International Publishing House Pvt.Ltd.
6- ***Environmental Engineering***
   (a) S.K. Garg, " Water Supply Engineering",KhannaPublishers
7- ***Surveying***

(a) *S.K. Duggal, " Surveying Vol. I",TMH*
(b) *B.C Punmia," Surveying &Levelling", LaxmiPublication*
(c) *K.R Arora," Surveying Vol. I", Standard Book House,Delhi*

PRODUCTION TECHNOLOGY

Course Objective:

This subject provides knowledge and develop skills on various machine operations viz capstan and turret lathe, milling, grinding, gear manufacturing, broaching and automatic machines which very essential for mechanical diploma holders to work in manufacturing industries.

UNIT-1:

Introduction ,study and uses of Capstan and Turret Lathe , Turret indexing mechanism, Bar feeding mechanism, Work holding devices and Tool holding devices –Jaw and collet chucks –Slide tool holder, Knee tool holder, knurling tool,holder, recessing tool holder, form tool holder, tap and die holder, V - steady box tool holder, roller steady, box tool holder, bar stops.

UNIT-2:

Introduction tooling layout,Comparison of capstan, turret and conventional lathe. Specification, Classification and working principle of milling machine applications of milling machines, up milling and down milling, Milling operations –face milling, angular milling, form milling, straddle milling and gang milling.

UNIT-3:

Grinding , Various elements of grinding wheel –Abrasive, Grade, structure, Bond, Grinding methods – Surface grinding, cylindrical grinding and centre less grinding. Gear Manufacturing Processes , Gear hobbing, Gear shaping, Broaching , Introduction Types of broaching machines –Single ram and duplex ram horizontal type, vertical type pull up, pull down, push down. Elements of broach tool, broach teeth details –nomenclature, types, tool material.

UNIT-4:

Metal Forming Processes, Press Working, Press working –Types of presses, type of dies, selection of press die, die material,Press Operations-Shearing, piercing, trimming, punching, notching, shaving, gearing, embossing, stamping, Forging, Open die forging, closed die forging,Pressforging, Extrusion and Drawing, Type of extrusion- Hot and Cold, Direct and indirect, Pipe drawing, tube drawing.

UNIT-5:

UNCONVENTIONAL MACHINING PROCESSES-Introduction, principle, process and application of Ultrasonic machining (USM) ,Electro chemical machining (ECM) ,Electro chemical Grinding (ECG), Electrical Discharge Machining (EDM), Laser beam machining (LBM), Electro beam machining (EBM), Plasma arc machining (PAM).

Importance and use of jigs and fixture Principle of location, Types of Jigs –Drilling jigs, bushes, template jigs, plate jig, channel jig.

UNIT-6:

Fixture for milling Advantages of jigs and fixtures, Plastic Processes Injection Blow moulding –working principle, advantages and limitations, Compression moulding ,Metallic and Non Metallic Coating Processes, powder process, Metal Finishing Processes, Lapping process, lapping compounds and tools, Brief idea of lapping machines, Super finishing process, its applications. Production of metal powders, sintering and finishing operations and extrusion Advantages, limitations and applications of powder metallurgy.

PRACTICAL EXERCISES

1. Preparation of a drilling gjig.
2. Preparation of a milling fixture.
3. Exercise on milling- slab milling, Gang milling and straddle milling
4. To produce a gearby indexing device on a milling machine
5. Preparing job on following machines:-a) Surface grinder ,b) Cylindrical grinder
6. Exercise on tool and cutter Grinder

a) To grind Lathe tools
b) To grind a drill bit
c) To grind a milling cutter

RECOMMENDED BOOKS

1. *Manufacturing technology by Rao; Tata McGraw hill Publishers, NewDelhi*
2. *Manufacturing technology by M. Adithan and AB. Gupta; New AgeInternational (P) Ltd, New Delhi*
3. *Workshop Technology vol I, II, III by Champman; Standard publishers Distributors*
4. *Practical hand book for Mechanical Engineers by AB Gupta; Galgotia publications, NewDelhi*

HYDRAULICS AND HYDRAULIC MACHINES

Course Objective:

Diploma holders in Mechanical Engineering are required to deal with problems of fluid flow and use of hydraulics in power generation. For this purpose, knowledge and skill about fluid mechanics, fluid flow and hydraulic machines are required to be imparted for enabling them to perform above function. This subject aims at development of knowledge and skills about various properties of the fluid, measurements of various flow parameters and about various hydraulic machines.

UNIT-1

Introduction- Fluid, types of fluid; properties of fluid viz mass density, weight density (specific weight), specific volume, capillarity, specific gravity, viscosity, compressibility.

Pressure and its Measurement-

1. Concept of Pressure (Atmospheric Pressure, gauge pressure, absolute pressure)
2. Pressure measuring devices: peizometer tube, manometers - simple U-tube, differential single column, inverted U-tube,micromanometer
3. Bourdon tube pressuregauge
4. Simple problems

UNIT-2

Flow of Fluids- Types of fluid flow- steady and unsteady, uniform and non- uniform, laminar and turbulent; rate of flow and their units; continuity equation of flow; Bernoulli's theorem (without proof) and its applications, Discharge measurement with the help of venturimeter, orifice meter and pitot tube, simple problems

UNIT-3

Notches and Weirs

Different type of notches, Measurment of discharge over rectangular notch. Francis and Brazin's formula for rectangular weirs, submerged weirs, broad crested weirs.

UNIT-4

Flow through orifices- Cc, Cv, Cd, flow through drowned, partially drowned orifices, time for emptying a tank through a circular orifice. Simple problems

Flow through pipes- Definition of pipe flow, wetted perimeter, hydraulic mean depth, hydraulic gradient; loss of head due to friction; Chezy's equation and Darcy's equation of head loss.§ Loss of head in pipes due to sudden enlargement, sudden contraction, obstruction on flow path, change of direction and pipe fittings, Simple problems

UNIT-5

Hydraulic Devices- Description, operation and application of hydraulic machines – hydraulic ram, hydraulic jack, hydraulic brake, hydraulic accumulator, hydraulic door closer, hydraulic press,

Water Turbines and Pumps- Concept of a turbine, types of turbines – impulse and reaction. Construction and working of pelton wheel, Francis turbine and Kaplan turbine. Concept of hydraulic pump. Construction, working and operation of reciprocating pump and centrifugal pump.

LIST OF PRACTICALS

1. Measurement of pressure head by employing
   i) Piezometertube
   ii) Single and double columnmanometer
   iii) Pressuregauge
2. To find out the value of coefficient of discharge for a venturimeter
3. Measurement of flow by using venturimeter
4. Verification of Bernoulli's theorem
5. To determine the coefficient of friction of pipe using Darcy's equation.
6. Study the working of a pelton wheel and Francis turbine
7. Dismantling and assembly of a single stage centrifugal pump to study its constructional details, operation including fault diagnosis.
8. To demonstrate the working of a KalpanTurbine.
9. To demonstrate the working of a single acting and double acting Reciprocating pump.
10. To determine Cd, Cv and Cc for a orifice.

RECOMMENDED BOOKS

1. *Hydraulics and Hydraulic Machines by RS Khurmi ; S.Chand & Co.New Delhi.*
2. *Hydraulics and Fluid Mechanics by Jagdish Lal; Metropolitan Book*

METROLOGY

Course Objective:

Diploma holders in these courses are required to measure and inspect for ensuring quality of product. For this purpose, knowledge and skills about standards of measurement limit, fits and tolerance, types of inspection and various measuring instruments are required. Hence this subject is offered.

Introduction

1. Definition of metrology
2. Standard of measurement - Primary, secondary, Tertiary and working standards.
3. Types of errors- Controllable and random errors
4. Precision, accuracy, sensitivity, hysterisis, response time,repeatability, calibration, uncertainty of measurement

Linear Measurement

1. Construction features and use of instruments for non precision linear measurement: steel rule, callipers, surface plate, angle plate,V-block.
2. Construction features and use of instruments for precision measurements: vernier calipers, vernier height and depth gauges, micrometers.
3. Slip gauges, Indian standards of slip gauges, sets of slip gauges, use ofslip gauges.
4. Cylinder bore gauges, feeler and wire gauges.
5. Comparators – Characteristics, uses, working principles of different types of comparators: mechanical, electrical, electronics and pneumatic comparator.

Angular Measurement

1. Construction and use of instruments for angular measurements: bevel Protector, sine bar, angle gauges, clinometers.
2. Optical instruments for angular measurement, auto collimator. Angledekkors
3. Circular divisions - optical dividing heads, circular dividing engine, rotarytables, other instruments

Measurement of Surface Finish

1. Terminology of surface roughness.
2. Concept of primary texture and secondary texture.
3. Factors affecting surface finish.
4. CLA, RMS and RA value.
5. Principle and operation of stylus probe instruments for measuring surface Roughness

Measurements of Screw threads and Gears

1. Measurement of screw threads- Introduction, measurements of external and core diameters, checking of pitch and angle of threads with gauges.
2. Effective diameter measurement by three wire method.
3. Measurements of gears (spur) – Measurement of tooth thickness, pitch, testing of alignment of teeth.

4. Profile projector, Coordinate Measuring Machine (CMM), Toolmaker's microscope.

Machine Tool Testing

Alignment test on lathe, drilling machine and milling machine.

Limits, Fits and Tolerances

1. Definition and terminology of limits, fits and tolerances.
2. Interchangeability
3. Hole basis and shaft basis systems.
4. Type of fits.
5. Standard and Limit gauges.

Instrumentation

Brief description about the measurement of displacement, vibration,frequency, pressure, temperature and humidity by electro mechanical transducers.

LIST OF PRACTICALS

1. Internal and external measurement with vernier - caliper and micrometer.
2. Measurement with height gauge and depth gauge.
3. Measurement of flatness with dial indicator.
4. Measurement with combination set and bevel protector.
5. Study and use of slip gauges.
6. Measurement of gear characteristics
7. Measurement of angle with sine bar and slip gauges
8. Measurement of worn out IC engine piston clearance between cylinder and piston.
9. Measurement of flatness using comparator.
10. Determination of temperature by (i) pyrometer (ii)thermocouple.
11. Use of feeler gauge, wire gauge, radius gauge and fillet gauges for checking of standard parameters.
12. Measurement of surface roughness of a surface

RECOMMENDED BOOKS

1. *Engineering Metrology by RK Jain; Khanna Publishers, NewDelhi*
2. *A Text Book of Production Engineering by PC Sharma; S Chand andCompany, NewDelhi.*
3. *Metrology Laboratory Manual by M Adithan and R Bahl; NITTTR,Chandigarh.*
4. *Engineering Metrology by RK Rajput; SK Kataria and Sons,Ludhiana*

INDUSTRIAL TRAINING

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 trainingorganization.

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 thefollowing.

a) Punctualityand regularity 15%
b) Initiative in learningnew things 15%
c) Relationshipwithworkers 15%

d) Industrialtrainingreport 55%

Computer Applications In Mechanical Drafting, Design And Analysis

Course Objective:

Today age is computer age. Most of our daily activities are being influenced by the use components. It has become necessary for diploma students to have basic knowledge of computer application related to their branch. The subject is being offered to provide further practice to students on MS Power Plant and MS Access and acquaint them to Computer Aided Design software for modeling, assembling and drafting.

UNIT-1:- MS Word

Introduction to MS word for preparing technical report. Use of different fonts, size, tables, and equations should be considered.

UNIT-2:- MS Excel

Creation of graphs such as bar chart, PI chart, line diagram using technical data, Examples: Load deformation data of any material may be given to the students and ask to convert these data to stress strain form and plot of stress strain curve. Determination of modulus of elasticity, yield strength, percentage elongation, ultimate strength, etc from the above curve. With given x-y data, plotting of the data and fitting various regression equations using Excel program.

UNIT-3:- MS Power Point

Templates, wizard, views, color schemes, Introduction to various Power Point toolbars, Presentations using Power Point:-

- Slide Views
- Slide Formatting
- Animation
- Graphs

UNIT-4:-

Computer Aided Design using any sotware such as AUTO CAD/ IDEAS/etc-

1. Concept of AutoCAD, Tool bars in Auto CAD, coordinate system, snap,grid, and ortho mode
2. Drawing commands – point, line, arc, circle,ellipse,
3. Editing commands – scale, erase, copy, stretch, lengthen andexplode.
4. Dimensioning and placing text in drawingarea

5. Sectioning andhatching
6. Inquiry for different parameters of drawingentity

Assembly and detail drawings of the following using AUTOCAD-
Tool post, Tail stock, Screw jack, Safety valve, Stuffing Box, Bench vice

UNIT-5:-

Isometric Drawings by CAD
Drawings of following on computer: Cone, Cylinder, Isometric view of objects

3D Modelling
3D modelling, Transformations, scaling, rotation, translation

Projectwork
Technical report writing where all such chapters are to be used.

NOTE :- Practical work must be performed on the related contents as described above. Strategy should be made in such a way that at first student should be taught the contents theoretically than related practical works must be performed**.**

RECOMMENDED BOOKS

1. *AutoCAD 2000 for you by Umesh Shettigar and Abdul Khader; Janatha Publishers, Udupi.*
2. *Machine Drawing by P.S. Gill; Kataria and Sons,Ludhiana.*
3. *A Text book of Machine Drawing by R.K. Dhawan , S.Chand and Company Ltd.,NewDelhi.*
4. *Engineering Drawing with AutoCAD 2000 by T. Jeyapooran; Vikas PublishingHouse,Delhi.*
5. *AutoCAD for Engineering Drawing Made Easy by P. Nageswara Rao; Tata McGraw Hill, NewDelhi.*

DYNAMICS OF MACHINES

Course Objective:

Diploma holders in Mechanical Engineering comes across many machines. He must have the knowledge of the various mechanism, power transmission devices, balancing of masses, vibration etc. Hence this subject is offered.

UNIT-1:- Basic Concepts

1. Definition of statics, dynamics, kinetics, and.kinematics
2. Rigid body and resistant body.
3. Links, its classification, Kinematics chain and their types
4. Kinematics pairs and it's classification.
5. Mechanism. Machine, Structure & Inversion
6. Degree of freedom, Types of joints, Problems on determination of degree of freedom of mechanism
7. Constrained motion, and it's classification.
8. Classification of mechanisms.
9. Equivalent mechanism.
10. Laws of inversion ofmechanisms.
11. Four bar chain and it'sinversion
12. Single slider crank chain and its inversions.
13. Double slider crank mechanism and it's inversion.
14. Applications of mechanisms and their selection from manufacture catalogue.
15. Indicator mechanism,pantograph.
16. Straight line mechanism such as Peaucellier and Harts mechanism 1,17 Steering gear mechanism such as Davis and Ackermanmechanism

UNIT-2:- FlyWheel

1. Turning moment diagram plotting and its purpose
2. Turning moment diagram for single cylinder double acting steam engine
3. Turning moment diagram for multi- cylinder engines
4. Fluctuation of energy of Flywheel
5. Functions of flywheel.
6. Types of flywheels.
7. Mass and size calculations in different cases

UNIT-3:- Governors

1. Functions of governor
2. Classification of governor - elementary knowledge of porter governor, Watt

governor, Proell governor, Porter governor, Hartnell governor and Wilson-Hartnel governor

3. Terminology used in governors
4. Gonernor effort and power
5. Hunting, isochronism, stability, sensitiveness of a governor
6. Controlling force diagram plotting and interpretation.
7. Simple problems related to watt, porter and proell governor.

UNIT-4:- Cams

1. Definition ofcam
2. Classification ofcams
3. Followers and their classification
4. Basic definition related tocams
5. Construction of displacement diagram of follower performing uniformvelocity.
6. Construction of displacement diagram of follower performingSHM
7. Construction of displacement diagram of follower performing uniform acceleration and deceleration
8. Simple cam profile for uniform velocity, SHM and uniform acceleration and deceleration

UNIT-5:- Power Transmission Devices (Belt, Rope and Chain Drive)

1. Introduction.
2. Belt, Rope and Chaindrives
3. Material for Belt, andRope
4. Open and crossed belt drives, action of belt on pulleys, velocity ratio.
5. Slip and Creep in belts,\
6. Types of V Belt and Flat belt, joint preparation for flatbelt.
7. Types of pulleys - step pulley, flat pulley, jockey pulley.\
8. Crowning inpulley.
9. Laws of belting and length of belt in case of open and crossbelt
10. Ratio of tensions in case of flat and Vbelt
11. Power transmitted and maximum power transmitted bybelt
12. Centrifugal force and its effect on belt tension
13. Initial tension and its effect on the transmission of maximumpower
14. Chain drive, chain length, classification ofchains
15. Selection of belt, chain and pulley for different applications on the basis of centre distance between the shaft, power to be transmitted, availability of space, velocityratio
16. Selection of rope based on the load to belifted
17. Simple problems on power transmitted by belts andropes

UNIT-6:- Gear Drive

1. Functions of gear
2. Classification of gears and Gear material
3. Gear nomenclature
4. Law ofgearing
5. Forms of teeth: Involute and Cycloidal
6. Comparison between Involute and Cycloidal gears
7. Simple, compound, reverted and epicyclic gear train

8. Horsepower transmitted by a geartrain
9. Selection of gear trains- simple andepicyclic

UNIT-7:- Brakes and Dynamometers

1. Introduction and Classification of brakes
2. Brief description of different types of Mechanical Brake such as block or shoe brake Simple and Differential band brake, band and block, internal expanding, power brake and discbrake
3. Simple problems related to determination of braking torque in case of shoe brake, Simple and Differential bandbrake
4. Definition and types of dynamometers, pony brake dynamometer, rope brake dynamometers, hydraulic dynamometer, belt transmission dynamometer and Bevis Gibson torsiondynamometer

UNIT-8:- Clutches

1. Function ofclutch
2. Classification of clutches
3. Principle of working of Disc clutch and Cone clutch with simple line diagram
4. Principle of working of Multi plate clutch and Centrifugal clutch calculation of frictional torque by uniform pressure and uniform wear theory in case of Single/multi plate clutch and Cone Clutch
5. Horse power transmitted
6. Selection of clutches for different applications from handbook/catalogue

UNIT-9:- Balancing

1. Need of balancing
2. Concept of static and dynamic balancing
3. Forces due to revolvingmasses
4. Balancing of single rotating mass by single mass in the sameplane
5. Balancing of single rotating mass by two masses in the differentplane
6. Concept of referenceplane
7. Balancing of several masses rotating in same plane
8. Balancing of several masses rotating in different planes
9. Balancing of unbalance due to reciprocating mass
10. Partial balancing of unbalance due to reciprocating mass

UNIT-10:- Vibrations

1. Introduction anddefinitions
2. Types of vibration - longitudinal, transverse and torsionalvibration
3. Basic features of vibratingsystems.
4. Damping ofvibrations
5. Vibration isolation andTransmissibility

RECOMMENDED BOOKS

1. *Mechanism and Machine Theory; JS Rao and Dukkipati; Wiley Eastern,NewDelhi.*

2. *Theory of Mechanism and Machine; A Ghosh and AK Malik, East West Press(Pvt.) Ltd., NewDelhi.*
3. *Theory of Machines; SS Rattan: Tata McGraw Hill, NewDelhi.*
4. *Theory of Machines by RS Khurmi and JK Gupta; S.Chand and Company Ltd.,NewDelhi.*
5. *Theory of Machines and Mechanisms by PL Ballaney; Khanna Publishers,NewDelhi*

MACHINE ELEMENT DESIGN

Course Objective:

This course is designed for the diploma level students of Mechanical and Automobile Engineering as first course in Machine Design. The contents of this subject are organized the intricacies of the different engineering design aspects. This will also help the students to enhance their imagination, innovative skill, adaptability to new situational and continued learning skills for problem solving.

UNIT-1:- Introduction

1. Design – Definition, Type of design, necessity of design
   1.1 Comparison of designed and undesigned work
   1.2 Design procedure
   1.3 Practical examples related with design procedure
   1.4 Characteristics of a good designer
   1.5 Characteristics of environment required for a designer
2. Design terminology: stress, strain, factor of safety, factors affecting factor of safety, stress concentration, methods to reduce stress concentration, fatigue, endurance limit. General design considerations
3. Engineering materials and their mechanical properties:
   3.1 Properties of engineering materials: elasticity, plasticity, malleability, ductility, toughness, hardness and resilience. Fatigue, creep, tenacity,strength
   3.2 Selection of materials, criterion of material selection, numbering systems for Cast Iron, steel, Aluminium alloys, IS/BS/ASTM standards for material specification

UNIT-2:- Design Failure for static loading

1. Brittle and ductile behaviour of the materials, Various design failures under static loading, causes of failure
   - Maximum principal stress theory.
   - Maximum shear stress theory
   - Distortion Energy theory
   - Mohr'stheory
   - Road maps for the selection of static failure theory for ductile and brittle materials

2. Design for tensile, compressive and torsional

loading

3. Design for combined torsion and bending

UNIT-3 :-

Design Equation for Impact loading- Examples of impact loading, stress and deflection due to impact load, selection of impact factor for minor, medium and heavy shock load

Design for Cyclic loading- Types of cyclic loading, failure of parts due to cyclic loading, design strength for cyclic loading, design equation for simple cyclic loading

UNIT-4:-

Design of Shaft

1. Type of shaft, shaft materials, Type of loading on shaft, standard sizes of shaftavailable
2. Design of shaft subjected to torsion on the basis of: Strength criterion,Rigidity criterion
3. Design of shaft subjected to bending
4. Design of shaft subjected to combined torsion and bending
5. Introduction to stepped shaft

Design of Key

1. Types of key, materials of key, functions of key
2. Failure of key (by Shearing and Crushing).
3. Design of key (Determination of key dimension)
4. Effect of key way on shaft strength. (Figures and problems).

UNIT-5:- Design of Joints

Types of joints - Temporary and Permanent, utility of joints.

Temporary Joint:

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).
2. Cotter Joint – Different parts of the joint, type of cotter joint – spigot and socket joint,gib and cotter joint, sleeve and cotter joint, Design of cotter joint (Figures and problems).

Permanent Joint: Welding symbols, standards and materials having high weldability.

1. Welded Joint - Type of welded joint, strength of parallel and transverse fillet welds.
2. Strength of combined parallel and transverse weld.
3. Axially loaded welded joints.
4. Riveted Joints. : Rivet materials, Rivet heads, leak proofing of riveted joint – caulking and fullering.
5. Different modes of rivet joint failure.
6. Design of riveted joint – Lap and butt, single and multi riveted joint

UNIT-6

Design of Flange Coupling:

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

Design of Screw, Nut, Bolt and Thread:

1. Form of thread (ISO), Type of nut heads, type of threads and their nomenclature.
2. Nature of loads on nut and bolts, types of failure of nut and bolts.
3. Initial stresses due to screwing up, stresses due to combination of different loads.

REFERENCE BOOKS

1. *Machine Design- Fundamentals and Practices, by P C Gope, PHI Learning Pvt Limited, NewDelhi. 2012*
2. *Machine Design by R.S. Khurmi and JK Gupta; Eurasia Publishing House*

OPERATIONS MANAGEMENT

Course Objective:

After studying the subject of production management, the students will be able to know the basics of production planning and control, industrial engineering, estimation & costing. This will enable them to understand and handle production environment effectively.

UNIT-1: Introduction

Operations management defined, history of development, functions of OM, scope & applications of OM, advantages-disadvantages.

UNIT-2:- Production and Productivity

Production, production functions, productivity, factors affecting productivity, measurement of productivity, causes of decrease in productivity, difference between production and productivity.

UNIT-3:-Plant Location, Layout and Material Handling

Plant location, factors affecting plant location, concept of plant layout, types of layout, their characteristics, factors affecting plant layout, work station design, factors considered while designing a work station, introduction, need and objective of material handling, factors considered while selecting a material handling device, safety concept of material handling equipment.

UNIT-4:- Work Study

Definition and scope of work study; areas of application of work study in industry, Role of work study in improving productivity, Objectives, needs and methods of method study, information collection, recording techniques, process symbols and its diagrams, critical examination, development, installation and maintenance of improved methods, work measurement objectives, needs and methods of work measurement, time study, various allowances, calculation of time, work sampling, standard data and its use. Application of engineered time standards and work sampling, Ergonomics, concept and advantages.

UNIT-5:- Production Planning and Control Introduction, objectives and components (functions) of P.P.C, Advantages of production planning and

Production Control, stages of P.P.C, process planning, routing, scheduling, dispatching and follow up, routing purpose, route sheets, scheduling – purpose, machine loading chart, Gantt chart, dispatching – purpose, and procedure, follow up – purpose and procedure. Production Control in job order, batch type and continuous type of productions. Difference between these controls.

UNIT-6:- Inspection and Quality Control Definitions, types of inspection and procedure, Quality, Quality control, Statistical quality control, Process capability, Control charts for variables - X and R chart, control chart, for fraction defectives (P chart), control chart for number of defects (C chart), Concept of ISO 9000, ISO 14000 and TQM, QualityCircles.

UNIT-7:- Estimation and Costing
Introduction, purpose/functions of estimating, costing concept, ladder and elements of cost, difference between estimation and costing. Overheads and their types, estimation of material cost, estimation of cost for machining processes, numerical problems.

RECOMMENDED BOOKS

1. *Industrial Engineering by O.P. Khanna; Dhanpat Rai and Sons, NewDelhi.*
2. *Industrial Engineering by S.C. Sharma; Khanna Publisher.*
3. *Industrial Engineering and Management by T.R.Banga.*
4. *Elements of work study by SureshDalela.*
5. *Production Management by Jain and Aggarwal.*

CNC MACHINES AND AUTOMATION

Course Objective:

Its primary purpose to create a faster production process and components tooling with more precise dimensions and material consistency, which in some case. Uses only the required amount of raw material , while simultaneously reducing energy consumption.

UNIT-1

Automation- Introduction to CAM, Automated Manufacturing system, Need of automation, Basic elements of automation, Levels of automation, Automation Strategies, Advantages & disadvantages of automation, Historical development and future trends.

Features of NC Machines-Fundamental of Numerical Control, elements of NC machine tools, classification of NC machine tools, Advantages, suitability and limitations of NC machine tools, Application of NC system, Methods for improving Accuracy considering the factors such as tool deflection and chatter and Productivity.

UNIT-2: NC Part Programming & Common Problems in CNC Machines

Part programming and basic concepts of part programming, NC words, part programming formats, simple programming for rotational components, part programming using canned cycles, subroutines and do loops, tool off sets, cutter radius compensation and wear compensation Manual (word address format) programming, Examples: Drilling, Turning and Milling, Canned cycles, Subroutine and Macro. APT programming, Geometry, Motion and Additional statements, Macro- statement. Common problems in mechanical, electrical, pneumatic, electronic and PC components of CNC machines, diagnostic study of common problems and Remedies , use of on-time fault finding diagnosis tools in CNCmachines.

UNIT-3

System Devices- Introduction to DC motors, stepping motors, feedback devices such as encoder, counting devices, digital to analog converter and vice versa.

Interpolators- Digital differential Integrator-Principle of operation, exponential declaration, DDA Hardware Interpolator- Linear, Circular, DDA Software Interpolator.

Control of NC Systems- Open and closed loops, Control of point to point systems, Incremental open loop control, Incremental close loop, Absolute close loop, Control loop in contouring systems, Adaptive control.

UNIT-4: Computer Integrated Manufacturing system

Group Technology, Flexible Manufacturing System, CIM, CAD/CAM, Computer aided process planning- Retrieval and Generative, Concept of Mechatronics, Computer aided Inspection.

UNIT-5

Robotics and Intelligent Manufacturing- Types and generations of Robots, Structure and operation of Robot, Robot applications, Economics, Robot programming methods. Introduction to Artificial Intelligence for Intelligent manufacturing.

LIST OF PRACTICAL

1. To study the basic feature and operation of NC, CNC machine & Study the constructional details of CNC lathe , working of following ,tool changer and tool setter ,Multiple pallets , Safety devices
2. To operate a CNC milling machine and become familiar with set-up, procedures and data flow
3. To use AutoCAD to define a series of closed 2-D polygons that form initials, or other artistic creations, within a 150 x 100 mm border. To run the output data file through the AutoLISP program called“digitize.lsp”.
4. To demonstrate how to program (using the computer-assisted method) and machine a simple part on the CNC lathe and Develop part programms for following lathe operations:
   4.1 Plain turning and facing operations
   4.2 Taper turning operations (internal and external)
   4.3 Thread cutting operations (internal and external)

Text Books:

1. *Numerical Control and Computer aided Manufacturing, By Kundra,Rao and Tewari.*
2. *Automation, Production Systems and Computer Integrated Manufacturing by MikellP.Groover.*
3. *Computer Aided Manufacturing by Kundra andRao.*
4. *Computer control of Manufacturing systems byKoren.*
5. *NC Machine Tools by S.J.Martin.*
6. *NC Machines byKoren.*
7. *CAD/CAM byGroover.*

Reference Books:

1. *Numerical Control Machine Tool by Y. Koren and Joseph BenUri.*
2. *Computer Aided Design and Manufacture by Groover and Zimmer,PHI.*
3. *Technology of Computer aided Design and Manufacturing by Kumar and Jha, Dhanpat Rai and Sons*
4. *CNC Machines –Programming and Applications by M Adithan and BS Pabla, New Age International (P) Ltd.,Delhi.*
5. *Computer Aided Manufacturing by Rao, Kundra and Tiwari; Tata McGraw Hill,NewDelhi.*
6. *Numerical Control of Machines Tools by Yorem Korem and IB Uri, KhannaPublishers, New Delhi.*

MAINTENANCE ENGINEERING

Course Objective:

A diploma engineer comes across installation, maintenance, testing, of various machines and equipment in industry. The layout of different machines, their foundation is in an important phenomenon of an industry. He should know the various method of testing and maintenance. This subject will enable diploma holders to deal with such aspects.

UNIT-1:- Introduction

1.1 Necessity and advantages of testing, repair and maintenance
1.2 Economic aspects, manpower planning and materials management
1.3 Fits and tolerances – common fits and tolerances used for various machine Parts

UNIT-2:- Erection and Commissioning of Machines (Installation)

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.

UNIT-3:-Testing of Machines

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, vibrtions, noise

UNIT-4:- Lubrication System

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 boxoil)

UNIT-5:- Repairing

5.1 Common parts which are prone to failure, reasons of failure
5.2 Repair schedule
5.3 Parts that commonly need repair such as belts, couplings, nuts, and bolts

UNIT-6:- Maintenance

1. Definition, advantages, limitations and types of maintenance viz. preventive, breakdown, predictive
2. Organization of maintenance
3. Introduction to computerized maintenance record\
4. ISO standards for maintenance documentation\
5. Introduction to machine history card – purpose and advantages
6. Preparation of yearly plan for preventive maintenance
7. Need of frequently needed spare parts inventory

LIST OF PRACTICALS

1. Preparation of prevention maintenance check.
2. Condition monitoring by non destructive testing.
3. Case study on trouble free maintenance.
4. Project on maintenance of utility equipment like compressors, pumps, driers,valves (actuator type valves).
5. Equipment/machine leveling and alignment.
6. Maintenance of material handling equipment – pulley blocks, hand operated cranes, fork lifts, hydraulic jacks, mobile cranes,winches.
7. Use of lubrication equipment like oil gun, grease gun.
8. Removing old lubricant, cleaning and replenishing the machine with fresh lubricant.
9. Case study on computerized maintenance schedule.
10. Reconditioning of machine parts.
11. Replacing gear.
12. Replacing bearings (all types).
13. Practically making different types of fits.

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., NewDelhi.

ENTREPRENEURSHIP DEVELOPMENT AND MANAGEMENT

Course Objective:

In the present day scenario, it has become imperative to impart entrepreneurship and management concepts to the students so that a significant percentage of them can be directed toward setting up and managing their own small enterprises. This subject forces on imparting the necessary competencies and skills of enterprise set up and its management.

SECTION– A ENTREPRENEURSHIP

1. Introduction
   - Concept /Meaning and its need
   - Qualities and functions of entrepreneur and barriers in entrepreneurship
   - Sole proprietorship and partnership forms of business organisations
   - Schemes of assistance by entrepreneurial support agencies at National, State, District level: NSIC, NRDC, DC:MSME, SIDBI, NABARD, Commercial Banks, SFC's TCO, KVIB, DIC, Technology Business Incubator (TBI) and Science and Technology Entrepreneur Parks (STEP)
2. Market Survey and Opportunity Identification
   - Scanning of business environment
   - Salient features of National and State industrial policies and resultant business opportunities
   - Types and conduct of market survey
   - Assessment of demand and supply in potential areas of growth
   - Identifying business opportunity
   - Considerations in product selection
3. Project report Preparation
   - Preliminary project report
   - Detailed project report including technical, economic and market feasibility
   - Common errors in project report preparations
   - Exercises on preparation of project report

SECTION–B MANAGEMENT

4. Introduction to Management
   - Definitions and importance of management
   - Functions of management: Importance and Process of planning,organising, staffing, directing and controlling
   - Principles of management (Henri Fayol, F.W.Taylor)
   - Concept and structure of an organisation
   - Types of industrial organisations
     a) Line organisation
     b) Line and staff organisation
     c) Functional Organisation
5. Leadership and Motivation
   a) Leadership
      - Definition and Need
      - Qualities and functions of a leader
      - Manager Vs leader
      - Types of leadership
   b) Motivation
      - Definitions and characteristics
      - Factors affecting motivation
      - Theories of motivation (Maslow, Herzberg,McGregor)
6. Management Scope in Different Areas
   a) Human Resource Management
      - Introduction and objective
      - Introduction to Man power planning, recruitment and selection
      - Introduction to performance appraisal methods
   b) Material and Store Management
      - Introduction functions, and objectives
      - ABC Analysis and EOQ
   c) Marketing and sales
      - Introduction, importance, and its functions
      - Physical distribution
      - Introduction to promotion mix
      - Sales promotion
   d) Financial Management
      - Introductions, importance and its functions
      - Elementary knowledge of income tax, sales tax, excise duty, custom duty and VAT
7. Miscellaneous Topics
   a) Customer Relation Management(CRM)
      - Definition and need
      - Types of CRM
   b) Total Quality Management(TQM)
      - Statistical process control
      - Total employees Involvement
      - Just in time(JIT)
   c) Intellectual Property Right(IPR)
      - Introductions, definition and its importance

- Infringement related to patents, copy right, trade mark

Note: In addition, different activities like conduct of entrepreneurship awareness camp extension lecturers by outside experts, interactions sessions with entrepreneurs and industrial visits may also be organised.

RECOMMENDED BOOKS

1. *A Handbook of Entrepreneurship, Edited by BS Rathore and Dr JS Saini; Aapga Publications, Panchkula(Haryana)*
2. *Entrepreneurship Development published by Tata McGraw Hill Publishing Company Ltd., NewDelhi*
3. *Entrepreneurship Development in India by CB Gupta and P Srinivasan; Sultan Chand and Sons, NewDelhi*

ADVANCED MACHINE DESIGN

Course Objective:

This is the second course of Mechanical Engineering . Application of the basic design principles for the components design of different machine parts should be emphasized.

UNIT-1 Introduction
Review of the design principle under static, impact and cyclic loading

UNIT-2 Design of power transmission systems

Design of flat belts, V belts selection procedure, Design of pulleys, Design of chain drives , Design of rope drives, Manufacturing methods of gear, Gear tooth profiles, Types of gear drives, selection of gear drives , Design of spur gears, helical, bevel and worm gears

UNIT-3 Selection of rolling contact bearing
Types of rolling contact bearing, their nomenclature Selection of bearing from SKF or TATA bearing of simple kind like ball, roller under axial and or thrust loading

UNIT-4 Journal bearing
Sliding contact bearing, terms used in journal bearing, Explain the use of Design chats

UNIT-5 Design of brakes
Different types of braking systems Braking materials Design of simple shoe and band brake

UNIT-6 Design of flywheels

Function of flywheel, Stresses in flywheel, Design of flywheel

UNIT-7 Designing clutches
Design procedure for positive clutches, Design of friction clutches, Design of cone clutch

RECOMMENDED BOOKS

1. *Machine Design- Fundamentals and Practices, by P C Gope, PHI Learning Pvt Limited,New Delhi. 2012*
2. *A Text Book of Machine Design by RS Khurmi & JKGupta, Eurasia Publishing House, Pvt. Ltd.., NewDelhi*
3. *Introduction to Machine Design by VB Bhandari, TMH,Delhi*
4. *Theory of Machines by PL Ballaney, Khanna Publishers, NewDelhi*
5. *Theory of Machines by DR Malhotra & HC Gupta, Satya Prakashan,Delhi*

AUTOMOBILE ENGINEERING

Course Objective:

The development of automobile industry direct and indirect dependence of the present day society on the services of its products has made the knowledge of the technology imperative , this subject deals with automotive needs.

UNIT-1 INTRODUCTION

Definitions and specifying an automobile, Automobile development and scope, Components of automobile, Classification of automobiles, Layout of chassis, Types of drives-front wheel, rear wheel, four wheel left hand, right hand, Body or super structure.

UNIT-2 TRANSMISSION SYSTEM

Clutch- Function, Constructional details of single plate and multi plate friction clutch, Centrifugal and semi centrifugal clutch, Hydraulic operation of single plate clutch, Clutch troubles.

Gearbox- 4-speed gearbox, Gear ratios, Working of sliding mesh, constant mesh and synchromesh 4-speed gearbox, Torque converter and overdrive, Transfer box

Propeller shaft and rear axle- Function, Universal joint, Final drive and differential assembly, Front driving axles, Real axle drives and different types of rear axles

Wheel and Tyres- Types of wheels- disc wheel, wire wheel and alloy cast wheel, Types of tyres used in Indian vehicles, Toe in, Toe out, camber, caster, king pin inclination, Tube less tyres

UNIT-3

Steering System- Function and principle, Ackerman and Davis steering gears, Types of steering gears – worm and ball nut, worm and wheel, worm and roller,rack and pinion type, Power steering, Wheel balancing, Wheel alignment.

Braking System- 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; Air brake, Emergency and Parking brake, Anti-lock braking system

Suspension System- Function**,** Types**,** Working of coil spring, leaf spring, rubber

springs**,** Shock absorber- telescopic type**,** Air suspension**,** Strut suspension.

UNIT-4:- **BATTERY**

Principles of battery, operation, Constructional details of lead acid cell battery, Specific gravity of electrolyte – effect of temperature 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, Battery leakage test.

UNIT-5:- **DYNAMO and ALTERNATOR**

Dynamo- Function and details, Regulator – voltage current and compensated type, Cutout – construction, working and their adjustment,

Alternator- Construction and working, Charging of battery from alternator

UNIT-6:- LIGHTING SYSTEM and ACCESSORIES

Lighting system, Wiring circuit, Head light, aiming of head lights,lighting switches, Direction indicators, Wind screen wiper, Horn, Speedo meter, Heater, Air conditioning Temperature indicator.

LIST OF PRACTICALS

Say any 8 study & exp. from the following or such experiments)

1. Study & experiment on braking system.
2. Study & experiment on fuel supply system.
3. Study & experiment on ignition system.
4. Study & experiment on steering system.
5. Study & experiment on transmission system.
6. Study & experiment on suspension system.
7. Study safety aspect of automobile design.
8. Study & experiment on Lighting or lubrication system.
9. Study & experiment on lubrication and cooling system.
10. Comparative study features of common small cars (such as fiat, Ambassador, Maruti, Matiz, Santro,Indica and its variations) available in India.
11. Comparative study & technical features of common scooters & motorcycles available in India. Casestudy/term paper.
12. Comparative Study & Technical features of common heavy vehicles available in India. Case study/term paper.
13. Engine tuning and carburator servicing experiment.

RECOMMENDED BOOKS

1. *Automobile Engineering vol. 1 by Dr. Kirpal Singh; Standard Publishers and Distributors, Delhi*
2. *Automobile Engineering by Dr. PSGill*
3. *Automobile Engineering Vol. 1 by GBS Narang; khanna Publishers,Delhi*

POWER PLANT ENGINEERING

Course Objective:

A diploma holder in mechanical engineering is supposed to manage the power generating plant. He must have relevant knowledge about various power plants. Hence this subject is offered.

UNIT-1:- Introduction

Sources of energy fuels, flowing stream of water, solar rays, wind, terrestial heat, ocean tides and waves Concept of power station, central and industrial power station, captive power station, classification of power station with respect to prime mover steam, IC engine, gas turbine and hydro power station, scope in Uttaranchalstate

UNIT-2:- Steam Power Plant

Parameters of power cycle- thermal efficiency, work ratio, specific steam Consumption Rankine cycle flow diagram, representation on thermodynamic planes, thermal efficiency, effect on change of condenser pressure, boiler pressure, degree of super heat on thermal efficiency Reheat cycle, simple regenerative cycle, (No numerical)

Steam primemovers- Concept of a prime mover, steam turbine- advantages as a prime mover, principle elements of a steam turbine and functions –nozzles, blades, rotor, shaft, casing, shaft seals, diaphragm, bearings, steam control, oil system Governing of steam turbines- classification of steam turbines Starting and stopping procedures for turbines, precautions during running Performance of steam turbine, Thermal efficiency, efficiency ratio, mechanical efficiency, steam rate

Steam Condensing Equipment- Functions of condensers, classification, surface condenser components and their functions Condenser auxiliaries- hot well, condensate pump, vaccum pump, air ejector, circulating pump, atmospheric relief valve Requirement of a good condensing system Cooling towers- purpose and types

Steam power station control- Effect of load variation of various parameters, types of

control systems-area and centralized, basic components of a control system, compressed air and electrical control systems, controls and instruments in a modern central station control room Working of feed water control system and steam temperature control system Records maintained in a steam power station and their purpose

UNIT-3:- Nuclear Power Plant

Equivalence between mass and energy- Atomic structure of matter, atomic nomenclature, nuclear reactions- fission, fusion, mass defect, binding energy, chain reaction, methods of control of rate of fusion reaction, types of nuclear materials, fissile and fertile materials Nuclear reactors- elements and functions of different elements, classification on the basis of different criteria Nuclear power stations employing boiling water rent reactor, candu type reactor-system components, advantages and dis advantages Comparison of nuclear power station with a steam power station Health hazards, safety precautions

UNIT-4:- Diesel Engine Power Plant

Advantages and disadvantages of diesel engine. Essential elements of diesel power plant. Fuel injection system performance, testing of diesel engine power plant

UNIT-5:- Gas Turbine Power Plant

Brayton cycle- schematic diagram, thermal efficiency. Advantages of gas turbines over diesel engines. Classification of gas turbines, advantages and disadvantages methods of improving thermal efficiency, Important parts and their functions, Essential auxiliaries and controls for gas turbine power point. Fuel for gas turbines

Unit-6:- Hydro Power Plant

Advantages, basic elements, dams, head works, water turbines, classification of water turbines, speed and pressure control, plant auxiliaries, plant operation, potential in Uttranchal state, detailed working

LIST OF PRACTICALS:-

The student will visit to different power plant station and prepare a report. The Evaluation of internal and external marks will be based on report as well as viva-voice.

RECOMMENDED BOOKS

1. *A course in Power Plant Engineering by S. Domkundwar & Arora; Dhanpat Rai and sons*
2. *Power Plant Engineering by G.B.S Narang*
3. *Power plant engineering by G.R. Nagpal; S.K. Khanna Publishers,Delhi*

MECHATRONICS

Course Objective:

The diploma holders need skills and knowledge that are not confined to single subject area . they need to capable of operating and communicating across a range of engineering disciples and linking those having more specialized skills. So it is important to introduce this subject.

UNIT-1:- Introduction

Introduction to Mechatronics General Behaviour of Mechatronic system & Measurement systems . Idea of different types of Control system as open Loop & Close loop. The Mechatronics approach

UNIT-2:- Sensing Elements and transducers

1. Resistive sensing elements: potentiometers, straingauges
2. Pressure Sensing Elements : Diaphragm, Borden and bellows tube, Load cell / Pressurecell
3. Capacitive sensing elements: variable separation, area anddielectric
4. Inductive sensing elements: variable reluctance and LVDT displacementsensors
5. Electromagnetic sensing elements: velocitysensors
6. Thermoelectric sensing elements: laws, thermocouple characteristics, installation problems
7. Liquid level and flow sensingelements\
8. Elastic sensing elements : sensing elements for force, torque,acceleration,\
9. Piezoelectric sensing elements: static and dynamiccharacteristics
10. Electrochemical sensing elements: PH meter, solid state gassensors
11. Photo sensing elements : Basic principle and characteristics of photo sources and photodetector,
12. Digital Transducer element, Micro sensor, smartsensors

UNIT-3:- Signal Recording and Display

Recording Requirements, Analog Recorders, Graphics Recorders, Strip Chart Recorders, Types of Strip Chart Recorders, Galvanometer Type Recorders, Null Type

Recorders, Potentiometric Recorders, Segmental Displays, Dot Matrices

UNIT-4:- Mechanical Actuation Systems

Mechanical systems Types of motion Kinematic chains Cams Gear trains Ratchet and pawlBelt and chain drives Bearing Mechanical aspects of motor selection Simpleproblems

UNIT-5:- Electrical Actuation System

Electrical systems Mechanical switches Solid- state switches Solenoids D.C. motors A.C. motors Stepper motors simple Problems

UNIT-6:- Basic System Models

Mathematical models Mechanical systems building blocks Electrical system building blocks Fluid system building blocks Thermal system building blocks Simple Problems

UNIT-7:- Pneumatic & Hydraulic control system

Brief Idea and Introduction of following control techniques-
ON-OFF Control, Proportional, Integral, Derivative, PI, PD, PID
Controller- Block Diagram & Circuits of pneumatic & hydraulic PI,PD & PID controller, Controller**,** Electronic Controller/AutomaticController

UNIT-8:- Programmable Logic Controller (PLC)

Introduction of PLC, Block Diagram of PLC, Characteristics function of PLC **,**Use of PLC in Mechanical Industry

UNIT-9:- Robotix

General Idea of robot, Brief Description and applications of Hexa Pod, Line follower, Automatic Management and blue boltz robots, Application of robot in Mechanical system, control Mechanism.

RECOMMENDED BOOKS

1- *Mechatronics by HMT, Tata McGraw Hill, NewDelhi*
2- *Mechatronics: Electronic Control System in Mechanical Engineering by W. Bolton; Pearson Education, Singapore.*
3- *Electronic Instrumentation; by H.S.Kalsi; McGraw-Hill Education India Pvt.Ltd. 4- Principles of Measurement Systems by John P.Bently(Pearson)*
5- *Electrical and Electronic Measurements and Instrumentation by A.K.Sawhney; DhanpatRai& Co.*
6- *Instrumentation measurement and Analysis by B.C. Nakra,K.K.Chaudhary*

LIST OF PRACTICALS

1. Measurement of Displacement using LVDT

2. Measurement of Temperature using Thermocouple
3. Application of Load Cell/PressureCell
4. Application of capacitive transducer
5. Application of Potentiometer
6. Application and use of Photocell
7. Application and use of graphic and strip chart recorder
8. Experiment of ON-OFF Controller
9. Experiment of Pneumatic PID Controller
10. Experiment of Hydraulic PID Controller
11. Application of PLC
12. Study and sketch of a general Robot
13. Study of feedback control in a Robot

PROJECT WORK

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 repair and maintenance of automobiles
- 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

A suggestive criteria for assessing student performance by the external (personnel from industry) and internal (teacher) examiner is given in table below:

Sr. No.	Performance criteria	Max. marks	Rating Scale				
			Excellent	Very good	Good	Satis-factory	Poor
1.	Selection of project assignment	15	15	12	9	6	3
2.	Planning and execution of considerations	15	15	12	9	6	3
3.	Quality of performance	25	25	20	15	10	5

4.	Providing solution of the problems or production of final product	20	20	16	12	8	4
5.	Sense of responsibility	10	10	8	6	4	2
6.	Self expression/ communication skills	10	10	8	6	4	2
7.	Interpersonal skills/human relations	10	10	8	6	4	2
8.	Report writing skills	25	25	20	15	10	5
9.	Viva voce	20	20	16	12	8	4
Total marks		**150**	**150**	**120**	**90**	**60**	**30**

Important Notes

1. This criteria must be followed by the internal and external examiner and they should see the daily, weekly and monthly reports while awarding marks as per the abovecriteria.

2. The criteria for evaluation of the students have been worked out for 100 maximum marks. The internal and external examiners will evaluate students separately and give marks as per the study and evaluation scheme ofexamination.

3. The external examiner, preferably, a person from industry/organization, who has been associated with the project-oriented professional training of the students, should evaluate the students performance as per the abovecriteria.

4. 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 nearby industries are approached for instituting suchawards.

The teachers are free to evolve another criteria of assessment, depending upon the type of project work.

It is proposed that the institute may organize an annual exhibition of the project work done by the students and invite leading Industrial organizations 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.

E M P L O A B L E SKILLS

Course Objective:

Diploma holders are required to not only posses subject related knowledge but also soft skills to get jobs and to rise steadily at their workshop. This subject is included to develop employ ability skills amongst the students.

1. Industrial Scenario Engineering Education and expectations of competences from an engineerbyemployer
2. Personality types, characteristic and features for a successful engineer
3. Professional Engineer desirable values and ethics and their development. Relation between engineering profession, society and environment
4. Managing project
    a. Leadership
    b. Motivation
    c. Time management
    d. Resource management
    e. Computer Software
    f. Interpersonal relationship
    g. Engineer economics and fundamentals
5. B effective Communication
    a. Listening
    b. Speaking
    c. Writing
    d. Presentation Technique/Seminar
    e. Group discussion
6. Preparing for Employment
    a. Searching for job/job hunting
    b. Resume Writing
    c. Interview technique in personal interview telephonic interview, panel interview, group interview, video conference
    d. Managers body, mind, emotion and spirit

7. Managing Self
    a. Stress Management
    b. Conflict resolution

8. Continuing professional development
    a. Organising learning and knowledge
    b. Use of computer for organising knowledge resource

9. Creativity, Innovation and Intellectual property right
    a. Concept and need in present time for an engineer

10. Basic rules, laws and norms to be adhered by engineers during their working