



**Indo-Swiss Training Centre  
CSIR-Central Scientific Instruments  
Organisation (CSIR-CSIO),  
Sector-30 C, Chandigarh**



## **CURRICULUM & EVALUATION SCHEME**

**OF**

**Three Years Diploma in Mechanical  
Engineering (Tool & Die)**

**&**

**Four Years Advanced Diploma in Mechanical  
Engineering (Die & Mould)**

**Study and Evaluation of ISTC 3-Years Diploma in Mechanical Engineering (Tool & Die) & 4 Years Advanced diploma in Mechanical Engineering (Die & Mould)**

**FIRST SEMESTER**

SUBJECT CODE	SUBJECT	THEORY/ PRACTICAL	EVALUATION SCHEME		TOTAL MARKS
			IA	SE	
DAM-101	APPLIED MATHEMATICS-I	THEORY	50	50	100
DAP-101	APPLIED PHYSICS	THEORY	50	50	100
DAC-101	APPLIED CHEMISTRY	THEORY	50	50	100
DME-101	TECHNICAL DRAWING-I	THEORY	50	50	100
DME-102	WORKSHOP TECHNOLOGY-I	THEORY	50	50	100
DCS-101	COMMUNICATION SKILLS	THEORY	50	50	100
DHL-101	HINDI	THEORY	50	50	100
DME-103	WORKSHOP PRACTICE - I	PRACTICAL	250	250	500
<b>TOTAL</b>			<b>600</b>	<b>600</b>	<b>1200</b>

**SECOND SEMESTER**

SUBJECT CODE	SUBJECT	THEORY/ PRACTICAL	EVALUATION SCHEME		TOTAL MARKS
			IA	SE	
DAM-201	APPLIED MATHEMATICS-II	THEORY	50	50	100
DEE-202	ELEMENTS OF ELECTRICAL ENGINEERING	THEORY	50	50	100
DEE-203	ELECTRONICS ENGINEERING	THEORY	50	50	100
DME-201	TECHNICAL DRAWING-II	THEORY	50	50	100
DME-202	WORKSHOP TECHNOLOGY-II	THEORY	50	50	100
DME-203	MATERIAL SCIENCE	THEORY	50	50	100
DEE- 207	BASICS OF COMPUTERS	THEORY	50	50	100
DME-204	WORKSHOP PRACTICE-II	PRACTICAL	250	250	500
<b>TOTAL</b>			<b>600</b>	<b>600</b>	<b>1200</b>

### THIRD SEMESTER

SUBJECT CODE	SUBJECT	THEORY/ PRACTICAL	EVALUATION SCHEME		TOTAL MARKS
			IA	SE	
DME-301	MODERN MACHINING TECHNOLOGY	THEORY	50	50	100
DME-302	ENGINEERING MECHANICS	THEORY	50	50	100
DME-303	ENGINEERING METROLOGY	THEORY	50	50	100
DME-304	CNC MACHINES	THEORY	50	50	100
DME-305	MACHINE DRAWING	THEORY	50	50	100
DME-306	ENGINEERING METALLURGY	THEORY	50	50	100
DME-307	WORKSHOP PRACTICE -III	THEORY	200	200	400
DEE-301	PNEUMATICS & HYDRAULICS LAB -I	PRACTICAL	50	50	100
<b>TOTAL</b>			<b>550</b>	<b>550</b>	<b>1100</b>

### FOURTH SEMESTER

SUBJECT CODE	SUBJECT	THEORY/ PRACTICAL	EVALUATION SCHEME		TOTAL MARKS
			IA	SE	
DME-401	STRENGTH OF MATERIALS	THEORY	50	50	100
DME-402	CAD/CAM/CIM	THEORY	50	50	100
DME-403	FUNDAMENTALS OF THERMODYNAMICS	THEORY	50	50	100
DME-404	TOOL DESIGN-I	THEORY	50	50	100
DME-405	MOULD TECHNOLOGY- I	THEORY	50	50	100
DEE- 412	PNEUMATICS & HYDRAULICS SYSTEM	THEORY	50	50	100
DME-407	WORKSHOP PRACTICE-IV	PRACTICAL	200	200	400
DEE-401	PNEUMATICS & HYDRAULICS LAB -I	PRACTICAL	50	50	100
<b>TOTAL</b>			<b>550</b>	<b>550</b>	<b>1100</b>

**FIFTH SEMESTER**

SUBJECT CODE	SUBJECT	THEORY/ PRACTICAL	EVALUATION SCHEME		TOTAL MARKS
			IA	SE	
DME-501	THEORY OF MACHINES	THEORY	50	50	100
DME -502	MACHINE DESIGN	THEORY	50	50	100
DME-503	FLUID MECHANICS & MACHINERY	THEORY	50	50	100
DME-504	JIGS & FIXTURES	THEORY	50	50	100
DME-505	TOOL DESIGN-II	THEORY	50	50	100
DME-506	MOULD TECHNOLOGY-II	THEORY	50	50	100
DME-507	8-WEEKS INDUSTRIAL TRAINING	PRACTICAL	100	---	100
DME-508	WORKSHOP PRACTICE -V	PRACTICAL	250	250	500
<b>TOTAL</b>			<b>650</b>	<b>550</b>	<b>1200</b>

**SIXTH SEMESTER**

SUBJECT CODE	SUBJECT	THEORY/ PRACTICAL	EVALUATION SCHEME		TOTAL MARKS
			IA	SE	
DME-601	INDUSTRIAL ENGINEERING & MANAGEMENT	THEORY	50	50	100
DME-602	INSPECTION & QUALITY CONTROL	THEORY	50	50	100
DEM-601	ENTREPRENEURSHIP DEVELOPMENT & MANAGEMENT	THEORY	50	50	100
DME-604	MACHINE TOOL DESIGN	THEORY	50	50	100
DME-605	PRODUCTION PLANNING & CONTROL	THEORY	50	50	100
DME-606	INNOVATION, DESIGN & MANUFACTURING	THEORY	50	50	100
DME-607	WORKSHOP PRACTICE- VI	PRACTICAL	250	250	500
DME-608	PROJECT WORK	PRACTICAL	50	50	100
DSA-609	STUDENT CENTERED ACTIVITIES*	--	100	---	100
<b>TOTAL</b>			<b>700</b>	<b>600</b>	<b>1300</b>

**SEVENTH SEMESTER (For 4 yrs. Diploma Curriculum)**

SUBJECT CODE	SUBJECT	THEORY/ PRACTICAL	EVALUATION SCHEME		TOTAL MARKS
			IA	SE	
DME-701	DESIGN OF FINE BLANKING DIES	THEORY	50	50	100
DME-702	PLASTIC TECHNOLOGY	THEORY	50	50	100
DEE-703	EMERGING TECHNOLOGIES –I	THEORY	50	50	100
DME-704	WORKSHOP PRACTICE- VII	PRACTICAL	250	250	500
DME-705	PROFESSIONAL PRACTICE - I	PRACTICAL	100	100	200
<b>TOTAL</b>			<b>500</b>	<b>500</b>	<b>1000</b>

**EIGHTH SEMESTER (For 4 yrs. Diploma Curriculum)**

SUBJECT CODE	SUBJECT	THEORY/ PRACTICAL	EVALUATION SCHEME		TOTAL MARKS
			IA	SE	
DME-801	DESIGN OF DIE CASTING DIES	THEORY	50	50	100
DME-802	DESIGN OF DEEP DRAWING DIES	THEORY	50	50	100
DEE-803	EMERGING TECHNOLOGIES –II	THEORY	50	50	100
DME- 804	WORKSHOP PRACTICE -VIII	PRACTICAL	100	100	200
DME -805	PROFESSIONAL PRACTICE - II	PRACTICAL	100	100	200
DME -806	PROJECT ON INDUSTRIAL APPLICATION	PRACTICAL	150	150	300
<b>TOTAL</b>			<b>500</b>	<b>500</b>	<b>1000</b>

**IA-** INTERNAL ASSESSMENT  
**SE-** SEMESTER EXAMINATION

\* Student Centered Activities includes participation of Students in NCC, Sports, Blood Donations, Cultural events, NSS, Seminar, Workshop, Quiz, Environmental awareness, camps, Industrial Visits, Social Awareness camps, etc. Marks shall also be deducted, if students involves in any indiscipline activity.

**Overall Marks of ISTC Diploma in Tool & Die – 3 Yrs. Course**

Semester	I	II	III	IV	V	VI	Grand Total
<b>Max. Marks</b>	<b>1200</b>	<b>1200</b>	<b>1100</b>	<b>1100</b>	<b>1200</b>	<b>1300</b>	<b>7100</b>

**Overall Marks of ISTC Diploma in Die & Mould – 4 Yrs. Course**

Semester	I	II	III	IV	V	VI	VII	VIII	Grand Total
<b>Max. Marks</b>	<b>1200</b>	<b>1200</b>	<b>1100</b>	<b>1100</b>	<b>1200</b>	<b>1300</b>	<b>1000</b>	<b>1000</b>	<b>9100</b>

**Break-Up of Student Centered Activities**

S. No.	Name of Activities	Marks
1.	NCC/NSS/Blood Donation/ Cultural Activities/CSIO Open Days/Industrial Visits, etc.	35
2.	Sports/Cross Country Race	15
3.	GD(English)	10
4.	GD(Hindi)	10
5.	Presentation/Exhibitions/Seminar/ Workshop/Quiz/Any Social activity Participations, etc.	20
6.	General Behavior	10
	<b>Total Marks</b>	<b>100</b>

# WORKSHOP PRACTICE

## **DME-108 WORKSHOP PRACTICE-I (FIRST SEMESTER):**

Skill based training on workbench, use of hand tools and measuring instruments. Introduction to drilling, tapping, turning, shaping. Training on precision machine tool operations: Shaper, lead screw lathe. Drawing (Title Block, Compass exercises, lines and curves) practice by using drafting machine.

## **DME-208 WORKSHOP PRACTICE-II (SECOND SEMESTER):**

Introduction to welding, soldering, brazing and re-sharpening of tools. Training on precision machine tool operations: Universal milling machine, Surface grinder. Advanced bench work for making different assemblies. Drafting and free hand sketching, Assembly drawing preparation manually using drafting machine.

## **DME-307 WORKSHOP PRACTICE-III (THIRD SEMESTER):**

Extensive practical work on lathe and milling machines. Use of special attachments on these machines. Practical instructions on proper clamping and centering. Use of carbide cutters. Application of differential dividing head. Advanced training on surface grinder, cylindrical grinder, tool & cutter grinder, single lip cutter grinder & three dimensional engraving. Practical training on Autocad software.

## **DME-407 WORKSHOP PRACTICE-IV (FOURTH SEMESTER):**

Introduction and use of basic quality assurance equipment in quality assurance room. Special measuring techniques. Training on jig boring machine and punch-shaper. Heat treatment of various types of jobs. Use of hardness tester. Practical training on Pro/E software.

## **DME-508 WORKSHOP PRACTICE-V (FIFTH SEMESTER):**

Training on special purpose machine tools and their attachments viz. Jig grinding, profile grinding, spark erosion, and copy milling. Use of milling machine as boring machine. Special grinding techniques on surface/cylindrical grinding. Use of sine table. Dressing a particular profile on the grinding wheel with radius and angular dressing attachment. Training on CNC milling and programming. Training on EDM Machine, Wire EDM, FMS, CIM Systems, CMM. Practical training on Pro/E & MasterCAM software, Project Work.

#### **DME-607 WORKSHOP PRACTICE- VI (SIXTH SEMESTER):**

Extensive workbench training on assembly of Press Tools, Moulds, Jigs & Fixture etc. Introduction to setting of power press, injection moulding machine and Hydraulic press for trial running. Advanced training in quality assurance room (Tool room microscope, profile projector). Polishing of mould cavities, use of diamond polishing pastes, use of different polishing aids and use of dies profile polishing machine. Tool Design. Training on EDM Machine, Wire EDM, FMS, CIM Systems, CMM. Practical training on Pro/E & MasterCAM software. Practical training on Pro/E & MasterCAM software.

#### **DME-704 WORKSHOP PRACTICE-VII (SEVENTH SEMESTER):**

Training on Special purpose machine tools and their attachments viz. Jig Grinding, Profile Grinding, Spark Erosion. Use of Milling machine as Boring machine. Special grinding techniques on surface/ Cylindrical grinding. Use of Sine and Angular dressing attachment. Training on CNC milling and programming.

#### **DME-804 WORKSHOP PRACTICE-VIII (EIGHTH SEMESTER):**

Extensive workbench training on assembly of Press Tools, Moulds, Jigs & Fixture etc. Introduction to setting of Power press, Injection moulding machine and Hydraulic Press for trial running. Advanced training in quality assurance room (Tool room microscope, Profile projector). Polishing of mould cavities, Use of diamond polishing pastes, Use of different polishing aids and use of die profile polishing machine. Manufacturing of Press tool parts, Impression taking and setting of cutting members. Assembly of Press tools, Maintenance of Press tool, Re- sharpening and troubleshooting. Designing and Manufacturing Dies, Moulds & Press Tool parts using CAD/CAM (AutoCAD, Pro- E & Mastercam)



## **LABORATORY WORK**

### **DEE-310 MECHATRONICS LAB-I (THIRD SEMESTER):**

Introduction to Hydraulics & Pneumatics Components: Study of Technical specifications & hands on use of basic hydraulic & pneumatic components making up the pneumatic air generation & hydraulic oil systems such as filters, different types of pressure regulators, relief valves etc. Study of Technical Specifications & hands on use of basic hydraulic & pneumatic components used on the equipment side such as actuators, pressure control valves, direction control valves & flow control valves etc.

### **DEE-410 MECHATRONICS LAB-II (FOURTH SEMESTER):**

Automation Studio: Designing & Simulating the basic electrical- control & power circuits, Basic & Advanced Pneumatic & Hydraulic Circuits, Basic & Advanced Electro-pneumatic and Electro-hydraulic circuits using Automation Studio software. Designing & Simulating Industrial circuits such as Clamp & Drill, Clamp & Press, Two hand safety circuit, DOL starter, Vertical Press etc.

## INDUSTRIAL TRAINING

### DME-507 INDUSTRIAL TRAINING (FIFTH SEMESTER):

The students undergo 8 weeks industrial training on after 4th semester of their study. After successful completion of their training the students are evaluated based on (a) submission of their training report and (b) Seminar presentation based on Evaluation Criterion given below:

<b>Criterion</b>	<b>Marks</b>
Training Report	40
Presentation	30
Viva-Voce	30
Total	100

## PROFESSIONAL PRACTICE

### DME-705 PROFESSIONAL PRACTICE-I (SEVENTH SEMESTER)

Each student would be assigned a specific Lab for furthering his/her knowledge in specific domain. The student would also assist the faculty in imparting practical training related to the lab.

<b>Criterion</b>	<b>Marks</b>
Attendance	50
Proficiency / Expertise	75
Level of Assistance/Training Provided	75
<b>Total</b>	<b>200</b>

### DME-805 PROFESSIONAL PRACTICE-II (SEVENTH SEMESTER)

Each student would be assigned a specific Lab for furthering his/her knowledge in specific domain. The student would also assist the faculty in imparting practical training related to the lab.

<b>Criterion</b>	<b>Marks</b>
Attendance	50
Proficiency / Expertise	75
Level of Assistance/Training Provided	75
<b>Total</b>	<b>200</b>

# DAM-101 APPLIED MATHEMATICS - I

## UNIT-I

**Algebra:** Complex Numbers: Complex number, representation, modulus and amplitude. De-moivre's theorem, its application in solving algebraic equation, Basics and properties of logarithms and its applications in solving problems related to basic logarithmic formulas, Geometrical progression, its  $n$ th term and sum of  $n$  terms and to infinity. Application of Arithmetic progression and Geometrical progression to Engineering problem such as maximum possible output of the machine, vibration of the spring, finding out capacity of tank etc, Partial fractions (linear factors, repeated linear factors, non-reducible quadratic factors excluding repeated factors), Permutations

and Combinations: Value of  ${}^n P_r$  &  ${}^n C_r$ . Simple problems of formulation of words from given alphabets (with and without repetition), circular permutations etc, Binomial theorem (without proof) for positive integral index (expansion and general form); binomial theorem for any index (expansion without proof) first and second binomial approximation with applications to engineering problems.

## UNIT-II

**Trigonometry:** Concept of angles, measurement of angles in degrees, grades and radians and their conversions. Applications of angles such as angle subtended by an arc, diameter of moon etc. 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 ( $2A$ ,  $3A$ ,  $A/2$ ), Graphs of  $\sin x$ ,  $\cos x$ ,  $\tan x$  and  $e^x$ , Applications of Trigonometric terms in engineering problems such as to find an angle of elevation, height, distance etc.

## UNIT-III

**Co-ordinate Geometry:** Cartesian and Polar coordinates (two dimensional), conversion from Cartesian to polar coordinates and vice-versa, distance between two points (Cartesian coordinates), section formula, Area of triangle when its vertices are given, co-ordinates of centroid, in center of a triangle when the vertices are given, simple problems on locus, Equation of straight line in various standard forms (without proof), intersection of two straight lines, angle between two lines. Parallel and perpendicular lines, perpendicular distance formula, General equation of a circle and its characteristics. To find the equation of a circle, given:

- Centre and radius
- Three points lying on it
- Coordinates of end points of a diameter.

Equation(s) of a straight line, circle, and conics (ellipse, parabola and hyperbola) and their applications in engineering problems.

## RECOMMENDED BOOKS

1. Elementary Engineering Mathematics by BS Grewal, Khanna Publishers, New Delhi
2. Engineering Mathematics by Vol. I & II by S Kohli, IPH, Jalandhar
3. Applied Mathematics, Vol. I & II by SS Sabharwal & Sunita Jain, Eagle Parkashan, Jalandhar
4. Engineering Mathematics, Vol I & II by SS Sastry, Prentice Hall of India Pvt. Ltd.,
5. Engineering Mathematics, Vol I & II by AK Gupta, MacMillan India Ltd., New Delhi

## DAP-102 APPLIED PHYSICS

### UNIT-I

**Units and Dimensions:** Physical quantities, Units - fundamental and derived units, systems of units (FPS, CGS, MKS and SI units), Dimensions and dimensional formulae of physical quantities, 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, Error in measurement, random and systematic errors Application of units and dimensions in measuring length, diameter, Circumference, volume, surface area etc. of metallic and non metallic blocks, wires, pipes etc.

### UNIT-II

**.Work, Power and Energy:** Work: definition and its SI units, Work done in moving an object on horizontal and inclined plane (incorporating frictional forces) with its application, Power: definition and its SI units, calculation of power with numerical problems, Energy: Definition and its SI units: Kinetic energy and Potential energy with examples and their derivation, Principle of conservation of mechanical energy (for freely falling bodies), transformation of energy from one form to another with its application, Friction: concept, types and its engineering applications., Application of Friction in brake system of moving vehicles, trains, aero planes and other objects.

**Force and Motion:** Scalar and vector quantities – examples, addition and multiplication (scalar product and vector product) of vectors, Force, resolution and composition of forces: resultant, parallelogram law of forces, equilibrium of forces, Newton's Laws of motion: concept of momentum, Newton's laws of motion and their engineering applications, derivation of force equation from Newton's second law of motion; conservation of momentum, impulse. Simple numerical problems Circular motion: angular displacement, angular velocity and angular acceleration, Relation between linear and angular variables (velocity and acceleration), Centripetal force (derivation) and centrifugal force with its application such as banking of roads, bending of cyclist, motion in vertical circle etc Application of various forces in lifts, cranes, large steam engines and turbines.

### UNIT-III

**Properties of Matter:** Elasticity: definition of stress and strain, different types of modulus of elasticity, stress – strain diagram, Hooke's law with its applications, Pressure: definition, its units, atmospheric pressure, gauge pressure, absolute pressure, U-tube, manometers and barometer gauges and their applications, Surface tension: concept, its units, angle of contact, measurement of surface tension by capillary tube method, applications of surface tension, effect of temperature and impurity on surface tension, Fluid motion, stream line and turbulent flow, Equation of Continuity, Bernoulli's Theorem and their applications, Viscosity and coefficient of viscosity: Buoyant force, buoyancy, Stoke's Law and derivation of terminal velocity, effect of temperature on viscosity and its application in hydraulic systems.

**Rotational Motion:** Concept of translatory and rotating motion with examples, Definitions of torque, angular momentum and their relationship, Conservation of angular momentum (qualitative) and its examples, 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 (Formulae only), Application of rotational motions in transport vehicles, trains and aero plane turbine/engine.

## UNIT-IV

**Heat and temperature:** Difference between heat and temperature, Modes of transfer of heat (Conduction, convection and radiation with examples). Properties of heat radiation, Different scales of temperature and their relationship, Principles of measurement of temperature, Thermal conductivity(definition),co-efficient of thermal conductivity.

### **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. New Delhi
5. Fundamentals of Physics by Resnick and Halliday & Walker, Asian Book Pvt. Ltd., New Delhi
6. Berkeley Physics Course, Vol. I, II & III, Tata McGraw Hill, Delhi
7. The Feynman Lectures on Physics by Feynman, Leighton and Sands, Vol. I & II, Narosa Publishing House, Delhi
8. Comprehensive Practical Physics, Vol. I & II, JN Jaiswal, Laxmi Publishers
9. Engineering Physics by PV Naik, Pearson Education Pvt. Ltd, New Delhi
10. Applied Physics I & II by RA Banwait & R Dogra, Eagle Parkashan, Jalandhar
11. Applied Physics by Jasmer Kaur and Bhupinder Singh, Lords Publications, Jalandhar City
12. Physics by Nelcon and Parker Publishers UK
13. Engineering Physics by Vanchna Singh and Sheetal Kumar, Cengage Learning India Pvt. Ltd. Patparganj, Delhi (year 2008)

# DAC-101 APPLIED CHEMISTRY

## UNIT-I

**Basic Concepts of Chemistry:** Matter, element, compound and mixtures, atoms, molecules, ions, symbols and formulae, Atomic mass (A), atomic number (Z) isotopes, isobars, isotone (recapitulation only), Mole concept, solution, standard solution, methods to express concentration of solution- molar mass, molar volume of gases, strength of solutions in grams per liter, molarity (M), molality (m), mass and volume percentages and mole fraction, Chemical equations, thermo-chemical equations, balancing of chemical equations and simple stoichiometric calculations, Numerical problems based on mole concept and molarity.

## UNIT-II

**Atomic Structure, Periodic Table and Chemical Bonding:** Fundamental particles- mass and charges of electrons, protons and neutrons with names of the scientists who discovered these fundamental particles, Bohr's model of atom. Successes and limitations of atomic theory (qualitative treatment only), Atomic number, atomic mass number isotopes and isobars, Chemical bonding and cause of bonding and types such as ionic bond in NaCl sigma ( $\sigma$ ) and pi ( $\pi$ ) covalent bonds in H<sub>2</sub>, HCl, Cl<sub>2</sub>, Metallic bonding- explanation with the help of electron gas (sea) model.

**Water:** Sources of water, impurities in water (dissolved –gases, salts and suspended), Classification of water – soft water and hard water, action of soap on hard water, types of hardness, causes of hardness, units of hardness – mg per litre (mgL<sup>-1</sup>) and part per million (ppm) and simple numerical, Boiler feed water and its quality - causes and prevention of, Scale and sludge formation, Priming and foaming, Boiler corrosion, Caustic embitterment, Disadvantages caused by the use of hard water in domestic and boiler feed water, Removal of hardness -Permutit process and Ion-exchange process, Indian Water Quality standards as per WHO/BIS, Natural water sterilization by chlorine and UV radiation and reverse osmosis.

## UNIT-III

**Electrochemistry:** Electronic concept of oxidation and reduction, redox reactions, Electrolytes, non-electrolytes and electrolysis, Faraday's Laws of electrolysis and applications in electrometallurgy and electroplating in automobile, Standard reduction potential (SRP), activity series, electrochemical cell and their e.m.f, Chemistry of commercial electrochemical cells, primary cells - Daniel cell and dry cell, secondary cell - lead acid storage cell, Wetson-cadmium cell, Ni-Cad battery, Li battery, Hg – button cell and Ag- button cell, Fuel cells, Simple numerical problems.

## UNIT-IV

**Lubricants:** Definition of lubricants and lubrication, Functions of lubricant, Mechanism of lubrication- hydrodynamic and thin film lubrication, Classification of lubricants, Lubricating oils, Greases, Solid lubricants, Properties of lubricants, Physical properties- viscosity and viscosity index, flash point and fire point, cloud and pour point, oiliness, volatility, colour, emulsification, Chemical properties- total acidity number (TAN), soapanification value, iodine value, aniline point, precipitation number, coke number, Application of various lubricating oils, greases, solid lubricants in automobile, mechanical and chemical industry.

## **RECOMMENDED BOOKS**

1. Chemistry in Engineering by J.C. Kuricose and J. Rajaram, Tata McGraw Hill, Publishing Company Limited, New Delhi.
2. Engineering Chemistry by P.C.Jain and Monika Jain, Dhanapat Rai Publishing Company, New Delhi.
3. Engineering Chemistry by Shashi Chawla.
4. Progressive Applied Chemistry – I by Dr. G.H. Hugar Eagle Prakashan, Jalandhar
5. Engineering Chemistry – A text Book by H. K. Chopra and A Parmer- Narosa Publishing House New Delhi.
6. Applied Chemistry-I by Dr.P.K. Vij & Shiksha Vij, Lords Publications, Jalandhar
7. Engineering Chemistry by Dr. Himanshu Pandey, Goel Publishing House, a unit of Krishna Prakashan Pvt. Ltd. Meerut, India, (year 2008)
8. Rapid Chemistry for peak performance by Anil Ahlawat, MTE books, 503, Taj Apartments, Ring Road, New Delhi (year 2008)
9. Applied Chemistry (Theory and Practice) by Vermani OP and Narula A.K., Cengage International Pvt. Ltd. New Delhi (year 2008)
10. Engineering Chemistry by Shelli Oberoi and Monica Malik, Cengage International Pvt. Ltd. New Delhi (year 2008)



# DME-104 TECHNICAL DRAWING-I

## UNIT-I

**Introduction to Engineering Drawing:** Definition of Engineering Drawing. Introduction to Drawing instruments, Sizes and layout of standard drawing sheets, Sizes of drawing boards, Drafting table/board.

**Technical lettering and Numerals in different sizes.**

## UNIT-II

**Lines:** Different types of lines in engineering drawing as per BIS specification & its applications.

**Scale:** Need and importance, Definition of representative fraction (RF); Find RF of a given scale, Types of scales, Construction of plain and diagonal scales.

**Dimensioning:** Necessity of dimensioning, terms and notations – methods and principles, dimensioning small components, 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 – chain and parallel dimensioning.

## UNIT-III

**Principle of Projections:** Principle of orthographic projection, isometric, diametric & axonometric projections, first & third angle projections, universal and special representations. Exercises on missing lines, surfaces and views.

## UNIT-IV

**Sectional Views:** Need for sectional views – cutting planes methods of representing sections, conventional sections of various material, classification of sections, conventions in sectioning Drawing of full section, half section, partial broken out sections, off-set sections, revolved sections and removed sections. Exercises on sectional views of different isometric views Drawing of different conventions for materials in section, conventional breaks for shafts, pipes, rectangular, square, angle, channel, rolled sections.

## RECOMMENDED BOOKS

1. A Text Book of Engineering Drawing by Surjit Singh; Dhanpat Rai & Co., Delhi
2. Engineering Drawing by PS Gill; SK Kataria & Sons, New Delhi
3. Elementary Engineering Drawing in First Angle Projection by ND Bhatt; Charotar Publishing House Pvt. Ltd., Anand
4. Engineering Drawing I & II by JS Layall; Eagle Parkashan, Jalandhar
5. Engineering Drawing I by DK Goel, GBD Publication.

# DME-105 WORKSHOP TECHNOLOGY-I

## UNIT-I

**Hand Tools and Measuring Tools:** Various types and uses of vices, V-block, surface plate, tri-square, combination set, files, chisels, hacksaw, scribes, punches, hammer, screw drivers, pliers, calipers, dividers, spanners.

Introduction to various types and uses of Vernier caliper, micrometer, height gauge, depth gauge dial gauge, bevel protector, plug gauges, snap gauges, slip gauges, taper & thread ring/plug gauges.

**Cutting Tools and Cutting Materials:** Various types of single point cutting tool and their uses, Single point cutting tool geometry, tool signature and its effect, Heat produced during cutting and its effect, tool life, Cutting parameters and their effect, type of chips produced.

Cutting Tool Materials - Properties of cutting tool material, Study of various cutting tool materials viz. High-speed steel, tungsten carbide, cobalt steel, cemented carbides, ceramics and diamond.

## UNIT-II

**Lathe Machine:** Introduction and working principle, Classification and specification of various types of lathe machine, Drives and transmission, Work and tool holding devices, Various cutting tools of Lathe: Parameters/Nomenclature & applications, Lathe machine operations: Plain and step turning, facing, parting off, taper turning, eccentric turning, drilling, reaming, boring, threading and knurling, form turning, spinning.

Cutting parameters – Speed, feed and depth of cut for various materials and for various operations, machining time, Speed ratio and preferred numbers of speed selection.

Lathe machine accessories:- Centers, dogs, different types of chucks, collets, face plate, angle plate, mandrel, steady rest, follower rest, taper turning attachment, tool post grinder, milling attachment, Quick change device for tools.

Brief description of capstan and turret lathe machine, comparison of capstan/Turret lathe, work holding and tool guiding devices in capstan and turret lathe.

**Shaping, Planing and Slotting:** Introduction and working principle, Types, Quick return mechanism applied to shaper, slotter and planer machine, Work holding devices, Types of tools used and their geometry.

## UNIT-III

**Drilling & Reaming:** working principle of drilling, Classification of drilling machines & description, drilling machine operations – drilling, spot facing, reaming, boring, counter boring, counter sinking, hole milling, tapping, Speeds and feeds during drilling, impact of these parameters on drilling, machining time, Types of drills and their features, nomenclature of a drill, Drill holding devices, types of reamers.

**Boring:** working principle of boring, Classification of boring machines and description, Specification of boring machines, Boring tools, boring bars and boring heads, Description of jig boring machine.

Specification of shaper, planer and slotting machine, Cutting parameters used in Shaping, Planing and Slotting processes.

## UNIT-IV

**Casting:** Introduction and working principle, Pattern Making : Types of pattern, Pattern material, Pattern allowances, Introduction to cores, core boxes and core materials, Core prints, positioning of cores, Moulding Sand: Properties of moulding sand, their impact and control of properties viz. permeability, refractoriness, adhesiveness, cohesiveness, strength, flow ability, collapsibility, Various types of moulding sand, Testing of moulding sand.

Mould Making: Types of moulds, Steps involved in making a mould, Molding boxes, hand tools used for mould making, Molding processes: Bench molding, floor molding, pit molding and machine molding, Molding machines: squeeze machine, jolt machine, jolt squeeze machine and sand slinger. Gating and Riser System: Introduction, Elements of gating system: Pouring basin, sprue, runner, gates, risers, Directional solidification.

Melting Furnaces: Construction and working of Pit furnace, Cupola furnace, Crucible furnace, Electric furnace.

Special Casting Processes: Principle, working and applications of Die casting: hot chamber and cold chamber, Investment casting, Centrifugal casting.

Casting Defects: Different types of casting defects.

### **RECOMMENDED BOOKS**

1. Workshop Technology by BS Raghuvanshi : Dhanpat Rai and Sons Delhi
2. Elements of Workshop Technology by SK Choudhry and Hajra : Asia Publishing House
3. Manufacturing Technology by M Adithan and A.B. Gupta; Wiley Eastern India Ltd. New Delhi.
4. A Text Book of Production Engineering by PC Sharma; S Chand and Company Ltd. Delhi
5. Foundry Technology by KP Sinha and DB Goel; Roorkee Publishing House, Roorkee.
6. A Text Book of Manufacturing Science and Technology by A Manna, Prentice Hall of India, Delhi.

## **DCS-106 COMMUNICATION SKILLS**

### **UNIT-I**

Intensive remedial course in English grammar, prepositions, correction, punctuation, Vocabulary, words, phrases, antonymsM Paragraph writing: technology, science, economics, political, social, general, English Speaking; GD's, About One-Self. Listening: Pearson and Longman series. Reading on various authors.

### **UNIT-II**

Formal letters, Informal letters, business letters, to prepare a project report, Acknowledgement of a project report, effective use of vocabulary, Paragraphs on current affairs/topics/themes, problem presentation.

### **UNIT-III**

Communication techniques: one & two way communications, essential of good communications, methods of effective oral, written & non-verbal communication.

### **UNIT-IV**

Intensive remedial course in English grammar, voice, narration, tenses. Vocabulary, idioms, phrases, synonyms.

### ***RECOMMENDED BOOKS***

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

- 1७ भाषा, वर्ण, स्वर, व्यंजन, वचन, लिंग, विलोम, पर्यायवाची, अशुद्ध संशोधन, विराम चिन्ह, सारांश, प्रैस नोट, तकनीकी शब्दावली, अनुवाद परिभाषा एवं व्यावहारिक अनुवाद, निर्धारित कहानी संग्रह।
- 2७ तकनीकी अनुवाद, तकनीकी शब्दावली, समानदर्शी शब्द, समानार्थक प्रतीत होने वाले शब्द, अनेकार्थक शब्द – अर्थ एवं वाक्य प्रयोग, व्यक्तिगत, व्यावसायिक, सरकारी, अर्धसरकारी, निजी पत्र लेखन, निर्धारित कहानी संग्रह।
- 3७ विपरीतार्थक, वाक्यांश के लिए एक शब्द, रिपोर्टाज लेखन, तकनीकी अनुवाद, तकनीकी शब्दावली, निबंध एवं लेख संग्रह, पाठ का विवेचन, कठिन शब्दों के अर्थ एवं प्रयोग।
- 4७ लोकोक्ति एवं मुहावरे (अर्थ एवं प्रयोग), प्रारूपण, टिप्पणी एवं निबंध लेखन, तकनीकी एवं व्यावसायिक विषयों पर विचार अभिव्यक्ति, तकनीकी अनुवाद, तकनीकी शब्दावली।

## DAM-201 APPLIED MATHEMATICS – II

### UNIT-I

**Algebra:** Determinants: Elementary properties of determinants up to 3rd order, consistency of equations, Cramer's rule. Matrix: Algebra of matrices, Inverse of a matrix, matrix inverse method to solve a system of linear equations in 3 variables. Application of Matrix in computer programming.

### UNIT-II

**Differential Calculus:** Definition of function; Concept of limits.

$$\text{Four standard limits } \lim_{x \rightarrow a} \frac{x^n - a^n}{x - a},$$
$$\lim_{x \rightarrow 0} \frac{\sin x}{x}, \quad \lim_{x \rightarrow 0} \frac{a^x - 1}{x}, \quad \lim_{x \rightarrow 0} (1+x)^{1/x}$$

Differentiation of  $x^n$ ,  $\sin x$ ,  $\cos x$ ,  $\tan x$ ,  $e^x$ ,  $\log_a x$ , Differentiation of sum, product & quotient of functions and function of a function, Differentiation of trigonometric inverse functions, Logarithmic, Exponential and Successive differentiation.

Application of differential calculus in:

- (a) Rate Measures
- (b) Errors and increments
- (c) Maxima and minima
- (d) Equation of tangent and normal to a curve

### UNIT-III

**Integral Calculus:** Integration as inverse operation of differentiation with simple examples, Simple integration by substitution, by parts and by partial fractions, Evaluation of definite integrals by explaining the general properties of definite integrals.

Applications of integration for:

- (a) Simple problem on evaluation of area bounded by a curve and axes.
- (b) Calculation of volume of a solid formed by revolution of an area about axes.
- (c) To calculate average and root mean square value of a function and
- (d) Area by Trapezoidal Rule and Simpson's Rule

**Differential Equations:** Solution of first order and first degree differential equation by variable separation method, Differential equations of homogeneous equation.

### UNIT-IV

**Statistics and Probability:** Measures of Central Tendency: Mean, Median, Mode with example of daily life, Measures of Dispersion: Mean deviation, Standard deviation, Probability definition and addition law of probability, theorem and simple numerical problems, General view of normal probability curve, Explanation of different sampling techniques.

### RECOMMENDED BOOKS

1. Elementary Engineering Mathematics by BS Grewal, Khanna Publishers, New Delhi.
2. Engineering Mathematics by Vol. I & II by S Kohli, IPH, Jalandhar
3. Applied Mathematics by Dr. RD Sharma
4. Applied Mathematics, Vol. I & II by SS Sabharwal & Sunita Jain, Eagle Parkashan, Jalandhar
5. Engineering Mathematics by C Dass Chawla, Asian Publishers, New Delhi

# DEE 202 - ELEMENTS OF ELECTRICAL ENGINEERING

## UNIT-I

**Concept of Electricity:** Modern electron theory, molecules, charges, different sources of electrical energy, various applications of electricity, advantages of electrical energy over other energy.

**Basic electrical quantities:** Definition of potential difference, voltage, current, power, energy. Effects of electric current, electrical symbols, units, abbreviations, concept and difference between AC & DC.

**DC Circuits:** Ohm's Law, series, parallel and series-parallel circuits Kirchhoff's Laws.

## UNIT-II

**Electromagnetism:** Electromagnetic induction, Faraday's Laws, Fleming's Rules, self induction, mutual induction.

**DC Machines:** Basic working principle of DC machine as a generator and a motor; Types and constructional features; commutator, EMF equation of generator, back EMF.

**AC fundamental & Circuits:** Generation of sinusoidal voltage- definition of average value, root mean square value, form factor, R, L, C, RL, RC and RLC circuits; real power, reactive power, apparent power and power factor, series, parallel and series-parallel circuits.

## UNIT-III

**AC Distribution system:** Concept of single phase and three phase system. Necessity and advantages of three phase systems, Phase sequence, balanced and un-balanced load; star and delta connections; calculation of load, selection of switch gears.

**Electrical safety and protective devices:** Concept of electrical safety, electric shock, electric fire, types of electrical faults, selection method of circuit breakers, types of circuit breakers, fuse, MCB, ELCB, RCCB, MCCB, Concept of earthing, necessity of earthing, methods of earthing, difference between grounding & earthing, leakage current, earthing resistance.

**Transformers:** Principle of operation and construction of single phase transformers (core and shell types), EMF equation, losses, efficiency and voltage regulation; voltage transformation ratio (K), KVA rating, efficiency, basic of three phase transformer, Instrument transformers (CT & PT).

## UNIT-IV

**Induction Motors:** Working principle of AC motor, concept of rotating magnetic field; principle of operation, constructional features; slip, applications of squirrel cage and slip ring motors; Necessity of a starter, DOL starter, star-delta starter, introduction to synchronous motor, types of single phase motors.

**Back-up system:** Concept of Cell and battery, Ah capacity, concept of online & offline UPS, selection of Inverter/UPS.

### RECOMMENDED BOOKS

1. Experiments in Basic Electrical Engineering: by S.K. Bhattacharya, KM Rastogi: New Age International (P) Ltd. Publishers, New Delhi
2. Electrical Engineering by JB Gupta, SK Kataria & Sons, New Delhi
3. Electrical Technology Vol. - I and II B.L. Thareja, S Chand and Co. New Delhi
4. Principles of Electrical Engineering and Electronics by V.K. Mehta, S. Chand Publishers.

# DEE-203 ELECTRONICS ENGINEERING

## UNIT-I

**Introduction** : Introduction to active and passive components, The specification of passive components, fixed and variable resistors their various types and specialization including thermistors, LDR and VDR and color codes fixed and variable capacitors, their various types and important specifications and color codes.

## UNIT-II

**Semiconductor Physics:** Intrinsic semiconductors Conductivity, atomic and crystal structure of germanium and silicon, covalent bonds, generation and recombination, effect of temperature on conductivity of intrinsic semiconductors, energy levels diagram of conductor, insulators and intrinsic semiconductors, Extrinsic semiconductor materials Doping of impurity, P and N type semiconductors and their conductivity, Minority and majority carriers; Drift and Diffusion currents.

## UNIT-III

**Semiconductor Diode:** PN junction diode and diode characteristics, Zener and avalanche breakdown, Semiconductor, Diode as rectifier, half & full wave rectifier, bridge rectifier, ripple factor, filter circuits, different types of diodes power diodes, Zener diodes; Varactor diodes and point contact diodes.

**Bipolar Transistor:** PNP and NPN transistors, CB, CE and CC configurations, comparison of CB and CC configuration, transistor as an amplifier in CE configuration, DC load line, voltage gain and current gain. Introduction to FET and MOSFET.

## UNIT-IV

**Basic Digital Electronics:** Binary Number Systems ; Octal Number system, Hexadecimal Number system, Basic Logic Gates and Truth Tables, Boolean Algebra, DeMorgan's Theorems, Realization of Universal gates.

**Power Supply:** Regulated DC Power Supply and Unregulated Power Supply.

## RECOMMENDED BOOKS

1. Electronics devices and circuits by Millman & Halkias



## DME-204 TECHNICAL DRAWING-II

### UNIT-I

**Detail and Assembly Drawing:** Principle and utility of detail and assembly drawings, 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 Mortice and Tenon joint, Corner and Through halving joint, Closed Mortise and Tenon joint.

### UNIT-II

**Screw Threads:** Nomenclature of Screw threads, types of Screw threads (metric), single and multiple start threads, Forms of various external thread sections such as V, square and acme threads, BA, BSW and Knuckle, Metric, Seller Thread, Buttress Threads, Simplified conventions of left hand and right hand threads, both external and internal threads.

**Nuts and Bolts:** Different views of hexagonal and square nuts; 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.

### UNIT-III

**Tolerances and fits:** Geometrical characteristics on machine parts viz. Straightness, flatness, cylindricity etc. Need of limit, fits and tolerance, Maximum limit of size, minimum limit of size, tolerance, allowance, standard deviations and IT grades system, upper deviation, lower deviation, fundamental deviation, clearance, maximum clearance, minimum clearance. Fits – clearance fit, interference fit and transition fit. Hole basis system, shaft basis system, tolerance grades, calculating values of clearance, interference, hole tolerance, shaft tolerance with given basic size for common assemblies like H7/g6, H7/m6, H8/p6.

**Surface Roughness:** Introduction-actual profile, Reference profile, Datum profile, Mean profile, peak-to-valley height, Mean roughness index, Surface roughness number. Use of machining symbols in production drawings, indication of surface roughness-indication of special surface roughness characteristics, Indication of surface roughness symbols on drawings, Method of indicating surface roughness on given components.

### UNIT-IV

**Development of sheet metal parts:** Development of sheet metal parts viz. Cones, pyramids, cylinders, intersection & penetration.

### RECOMMENDED BOOKS

1. A Text Book of Engineering Drawing by Surjit Singh; Dhanpat Rai & Co., Delhi
2. Engineering Drawing by PS Gill; SK Kataria & Sons, New Delhi
3. Elementary Engineering Drawing in First Angle Projection by ND Bhatt; Charotar Publishing House Pvt. Ltd., Anand
4. Engineering Drawing I & II by JS Layall; Eagle Parkashan, Jalandhar
5. Engineering Drawing I by DK Goel, GBD Publication.

## DME-205 WORKSHOP TECHNOLOGY-II

### UNIT-I

**Milling:** Introduction and working principle, Nomenclature and types of milling cutters and work mandrels, Classification, brief description and applications of milling machines, Details of column and knee type milling machine, Milling machine accessories and attachment- Arbors, adaptors, collets, vices, circular table, indexing head and tail stock, vertical milling attachment, Milling methods - up milling and down milling, Work holding devices, Milling operations – face milling, angular milling, form milling, straddle milling and gang milling. Cutting speed and feed, simple numerical problems.

Indexing on dividing heads, plain and universal dividing heads. Indexing methods: direct, Plain or simple, compound, differential and angular indexing, numerical problems on indexing, Thread milling.

**Grinding:** Purpose of grinding, Various elements of grinding wheel – Abrasive, Grade, structure, Bond, Common wheel shapes and types of wheel – built up wheels, mounted wheels and diamond wheels. Specification of grinding wheels as per BIS. Truing, Dressing, balancing and mounting of wheel. Grinding methods – Surface grinding, cylindrical grinding and Centreless grinding.

Grinding machine – Cylindrical grinder, surface grinder, internal grinder, Centreless grinder, tool and cutter grinder, Selection of grinding wheel, Thread grinding.

### UNIT-I

**Broaching:** Introduction and working principle of broaching, Types of broaching machines – Single ram and duplex ram horizontal type, vertical type pull up, pull down, push down. Elements of broach tool, broach tooth details – nomenclature, types, and tool material.

**Metal Forming Processes:** 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, Press forging, upset forging, swaging, up setters, roll forging, Cold and hot forging, Rolling - Elementary theory of rolling, Types of rolling mills, Thread rolling, roll passes, Rolling defects and remedies, Extrusion and Drawing - Type of extrusion - Hot and Cold, Direct and indirect. Pipe drawing, tube drawing, wire drawing.

### UNIT-IV

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

**Gas Welding:** Principle of operation, Types of gas welding flames and their applications, Gas welding equipment - 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: Classification, B.I.S. specification and selection, 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, Atomic hydrogen welding, Shielded metal arc welding, submerged arc welding, Welding distortion, welding defects, methods of controlling welding defects and inspection of welded joints.

**Modern Welding Methods:** Introduction to Tungsten inert gas (TIG) welding, Metal inert gas (MIG) welding, Thermit welding, Electro slag welding, Electron beam welding, Ultrasonic welding, Laser beam welding, Robotic welding & applications.

**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.

### ***RECOMMENDED BOOKS***

1. Workshop Technology by B.S. Raghuwanshi; Dhanpat Rai and Sons; Delhi
2. Manufacturing Technology by M. Adithan and A.B. Gupta; New Age International (P) Ltd, Delhi.
3. Elements of Workshop Technology by SK Choudhry and Hajra; Asia Publishing House
4. A Text Book of Production Engineering by PC Sharma; S Chand and Company Ltd. Delhi

# DME-206 MATERIAL SCIENCE

## UNIT-I

**Introduction:** Engineering materials, History/Timeline of Material Origin, Scope of Material Science, Overview of different engineering materials and applications, Importance, Classification of materials, Difference between metals and non-metals, Physical and Mechanical properties of various materials, Present and future needs of materials, Various issues of Material Usage-Economical, Environment and Social, Overview of Biomaterials and semi-conducting materials.

## UNIT-II

**Crystallography:** Crystalline solid and amorphous solid, Unit Cell, Space Lattice, Arrangement of atoms in Simple Cubic Crystals, BCC, FCC and HCP Crystals, Number of atoms per unit Cell, Atomic Packing Factor, coordination number (without derivation), Defects/Imperfections, types and effects in Solid materials, Deformation: Overview of deformation behaviour and its mechanisms, Elastic and Plastic deformation, behaviour of material under load and stress-strain curve, Failure Mechanisms: Overview of failure modes, fracture, fatigue and creep.

**Metallurgy:** Introduction, Cooling curves of pure metals, Dendritic solidification of metals, effect of grain size on mechanical properties, Binary alloys, , Thermal equilibrium diagrams, Lever rule, Solid Solution alloys.

## UNIT-III

**Metals and Alloys:** Ferrous Metals: Different iron ores, Flow diagram for production of iron and steel, allotropic forms of iron- Alpha, Delta, Gamma. Basic process of manufacturing of pig iron and steel-making, Cast Iron: Properties, types of Cast Iron, manufacture and their use. Steels: Plain carbon Steels and alloy steel, Classification of plain carbon steels, Properties and application of different types of Plain Carbon Steels, Effect of various alloying elements on properties of steel, Uses of alloy steels (high speed steel, stainless steel, silicon steel, spring steel) Non Ferrous Materials: Properties and uses of Copper, Aluminium and their alloys.

## UNIT-IV

**Heat Treatment:** Definition and objectives of heat treatment, Iron carbon equilibrium diagram, different microstructures of iron and steel .. Formation and decomposition of Austenite, Martensitic Transformation. Various heat treatment processes- hardening, tempering, , annealing, normalizing, surface hardening , carburizing, nitriding, cyaniding. Hardenability of Steels, Types of heat treatment furnaces (only basic idea), measurement of temperature of furnaces.

## RECOMMENDED BOOKS

1. Text book of Material Science by R.K. Rajput; Katson Pubs, Ludhiana
2. Text book of Material Science by V.K. Manchanda and GBS Narang; Khanna Publishers, New Delhi
3. Introduction to Material Science by A.R. Gupta, Satya Prakashan, New Delhi.
4. Material Science by Hazra, Chaudhary.

# DEE-207 BASICS OF COMPUTERS

## UNIT-I

**Mother Board:** Introduction to different type of mother boards, Single Board Based System, Block diagram of motherboard. Installation of Computer System.

**Buses and Ports:** Different type of Buses PCI, SCSI and Serial and Parallel ports (COM ports), Ports COM 1, LPT1, USB. RS 232 C, use of computer for instrumentation.

## UNIT-II

**Computer Fundamentals:** Study of computer systems using block diagrams, Generation wise growth of computers from vacuum tubes to ICs with parallel processing, Specifications of a Personal Computer and important Peripherals of computer system, keyboard, mouse etc.

**Computer Hardware:** Identification and study of different parts of computer like Mother Boards, Memory & its Types, Disk Drives, Monitors, working principles of Dot Matrix Printer, Inkjet Printer, Laser Printer and other peripheral devices and their interconnections.

## UNIT-III

**Operating System:** Introduction to computer Operating System (Dos, Windows'95, UNIX). Brief Introduction to DOS internal & external commands, Familiarization with windows structures, its use and application. Command Line and graphic user interfaces.

## UNIT-IV

**Basic of Computer Networking:** basic hubs, switches, routing, networking protocols (LAN, MAN, WAN) and their topologies.

**Applications Software & Basics of Internet:** Text editors like Microsoft word, Excel, power point etc.

## **RECOMMENDED BOOKS**

1. Computer organization and design : the hardware/software interface-by David A. Patterson and John L. Hennessy
2. The Beginner's Guide to Engineering: Computer Engineering-by James Lance

# DME-301 MODERN MACHINING TECHNOLOGY

## UNIT-I

**Modern Machining Processes:** Need and importance of modern machining processes, Classification, Mechanical Process – Water Jet Machining (WJM), Abrasive Jet Machining (AJM) and Ultrasonic machining (USM): Introduction, principle, process, advantages and limitations, applications, Electro Chemical Processes - Electro chemical machining (ECM) – Fundamental principle, process, applications, Electro chemical Grinding (ECG) – Fundamental principle, process, application, Electrical Discharge Machining (EDM) - Introduction, basic EDM circuit, Principle, metal removing rate, dielectric fluid, applications, Wire-EDM Machine, Laser beam machining (LBM) – Introduction, machining process and applications, Electro beam machining (EBM)- Introduction, principle, process and applications, Plasma arc machining (PAM) and welding – Introduction, principle process and applications.

## UNIT-II

**Metallic Coating Processes:** Introduction and need of metallic coating, Metal spraying – Wire process, powder process, applications, Electro plating, anodizing and galvanizing, Organic Coatings- oil base paint, rubber base coating.

**Metal Finishing Processes:** Need and importance of finishing surfaces, Surface roughness- Definition and units, Honing Process, its applications, Description of hones, Brief idea of honing machines, Lapping process, its applications, Description of lapping compounds and tools, lapping machines- Introduction, Super finishing process, its applications, Use of super finishing attachment on center lathe, Polishing, Buffing.

## UNIT-III

**Gear Manufacturing and Finishing Processes:** Nomenclature and types of gear, Gear hobbing, Gear shaping, Gear finishing processes.

## UNIT-IV

**Special Manufacturing Machines:** Punch shaping, types, construction & parts, controls, application in tool & die making, attachments, Jig Boring and Jig Grinding; Application, constructional features, coordinates calculation, boring tools, planetary motion in Jig Grinding, grinding wheel materials, Jig boring & Jig grinding machine.

Copy milling, Application of copy milling and engraving machines, principle of the pantograph, engraving machines, copy milling machines, universal copy-milling machines, copy milling with templates.

Profile grinding, Profile grinding with diaform attachment, optical profile grinding machines, pantograph profile grinding machines.

### **Recommended Books:**

1. Manufacturing Technology by Rao; Tata McGraw Hill Publishers, New Delhi.
2. Workshop Technology-III by K.P.S. Chouhan, Eagle Parkashan, Jalandhar.
3. Manufacturing Technology by M. Adithan and A.B. Gupta; New Age International (P) Ltd., New Delhi.
4. Workshop Technology Vol. I, II, III by Chapman; Standard Publishers Distributors, New Delhi.
5. Practical Handbook for Mechanical Engineers by Dr. AB Gupta; Galgotia Publications, New Delhi.

6. Production Technology by HMT; Tata McGraw Publishers, New Delhi.
7. Production Engineering and Science by Pandey and Singh; Standard Publishers Distributors, New Delhi.
8. Modern Machining Processes by Pandey; Tata McGraw Publishers, New Delhi.
9. A Text Book of Production Engineering by P.C. Sharma; S. Chand and Company Ltd., New Delhi.
10. Workshop Technology Vol-III, by R.P. Dhiman, Ishan Publications Jalandhar

# DME-302 ENGINEERING MECHANICS

## UNIT-I

**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 for density, force, pressure, work, power, velocity, acceleration Concept of rigid body, scalar and vector quantities.

## UNIT-II

**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.

**MOMENT:** Concept of moment, Moment of a force and units of moment, Varignon's theorem, Principle of moment and its applications (Levers – simple and compound, steel yard, safety valve, reaction at support), 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, Position of resultant force by moment.

## UNIT-III

**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. 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.

**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.

## UNIT-IV

**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 (1st, 2nd, 3rd system of pulleys), determination of velocity ratio, mechanical advantage and efficiency. Working principle and application of wheel and axle, Weston's Differential Pulley Block, simple screw jack, worm and worm wheel, single and double winch crab. Expression for their velocity ratio and field of their application.



### **RECOMMENDED BOOKS**

1. A Text Book of Applied Mechanics by S Ramamurtham, Dhanpat Rai Publishing Co. Ltd.
2. A Text Book of Engineering Mechanics by RK Khurmi; S Chand and Co. Ltd., New Delhi.
3. A Text Book of Applied Mechanics by RK Rajput; Laxmi Publications, New Delhi..
4. Text Book of Applied Mechanics by Birinder Singh, Kaption Publishing House, New Delhi.

# DME-303 ENGINEERING METROLOGY

## UNIT-I

**Introduction:** Measurement, definition, aim, method of measurement, generalized measurement system, Metrology, Necessity of Metrology & its objectives. Effect of external and internal factors on precision measurement accuracy, precision, calibration, threshold, sensitivity, hysteresis, repeatability, linearity, loading effect, system response time delay, Errors in measurement, Classification of errors.

**Standard of Measurements:** Introduction, legal status, present measurement system & its advantage over previous system, standard of length, mass, time, temp. etc.

**Straightness, Flatness, Squareness and Parallelism:** Introduction and Measurement of straightness. Straight edge method, Wedge method, The level method The Autocollimator method, Flatness, Definition, Flatness measurement using, Direct comparison, Dial gauge, Flatness comparators, Liquid methods, Autocollimator or Level method, Squareness, Engineers square, Indicator method, Autocollimator method, Parallelism.

## UNIT-II

### **Angular and Taper Measurements:**

Introduction Instruments for Angular Measurement-Protractors, Sine Bar, Sine Table, Sine Centre, Clinometers, Optical instrument for angular measurements. Taper Measurement-Gauge for Taper, Taper measuring instruments.

**Surface Testing & Measurement:** Introduction, Surface Texture, Methods of measuring surface finish, Surface Inspection by comparison methods-Touch inspection. Visual inspection, Scratch inspection, Microscopic inspection, Surface photographs, Comparison by standard specimens, Direct instrument measurement, Intersection method, Interference method, Stylus method.

## UNIT-III

**Measurement of Force, Torque, Power & Temperature:** Transducers, transfer efficiency, primary & secondary transducers, electrical, mechanical, electronic transducers. Force Measurement: Introduction, Force balance, hydraulic load cell, pneumatic load cell, Elastic force devices, Separation of Forces – calibration. Torque & Power Measurement: Definition, Transmission, Dynamometer, Driving type Dynamometer, Absorption Dynamometer. Temperature Measurement: Introduction, Non Electrical methods, Electrical methods, Radiation methods.

**Screw Thread & Spur Gear Measurements:** Errors in threads, screw thread gauges, measurement of elements of the external & internal threads using caliper gauges, various other methods to measure screw thread parameters. Geometry of spur gear, measurement of spur gear parameters, run out, pitch, profile, lead, backlash, tooth thickness, various other methods to measure spur gear parameters.

## UNIT-IV

**Advanced Measurement Techniques:** Optical Profile Projector – working principle, use, precautions in use. Coordinate Measuring Machine (CMM) – Types, uses, advantages, possible source of error in CMM. PC Based Metallurgical Microscope – Introduction, Structure and Grain Size Measurement, Image Analysis and Measurement. Surface Roughness Tester, Digital Micro Hardness Tester, Laser Interferometer & its types.

**Recommended Books:**

- 1.) A.J.T.Scarr, Metrology & Precision Engineering, Mcgraw Hill, N.York
- 2.) R.K.Jain, Engineering Metrology, Khanna Publishers, New Delhi
- 3.) Khare & Vajpayee, Dimensional Metrology, New Delhi
- 4.) O.P.Khanna, Metrology & Instrumentation, Dhanpat Rai Publication.

# DME-304 CNC MACHINES

## UNIT-I

**Introduction:** Introduction to machining, production & manufacturing, Machining parameters, Introduction to CAD/CAM, Historical development of machines & machining parameters, Introduction to NC Machines, Problems with conventional NC, CNC machines, DNC systems, Advantages and Disadvantages, Applications and suitable characteristics of components produced on CNC machines.

## UNIT-II

**NC Systems:** Basic components of a NC system, Programme of Instructions, NC Coding, Machine control unit, Machine Tool, The NC procedure.

**CNC machines:** Constructional details & tooling, Classification of CNC machines based on control system and on motion control system, Coordinate system, axis Identification, several zero's of CNC machine. Machine structure, Slide-ways, Spindle, Drive units, Motion transmission elements, Sensors and feedback devices, Location of Transducers/Control Elements, Work and tool holding devices, Swarf removal and safety considerations, CNC turning center & Milling center. Tooling requirements of CNC machines, Pre-set & qualified tools, Work and tool holding devices in CNC machines, Automatic tool changers, and multiple pallet systems.

## UNIT-III

**Fundamentals of Part Programming:** Introduction, NC words, Various function related to machining motions, Programming formats, Writing a program, Machining in point to point & along straight line, Examples of programming for Lathe & CNC Milling Machine operations, Cutter Radius Compensation, Exercises on part programs.

## UNIT-IV

**Advanced and Computer Aided Part Programming:** Introduction, Sub-routines, Do Loops, Canned Cycles, Fixed cycles for Lathe operations, Fixed cycles for CNC Milling Machine and Machining Center operations, Exercises on part Programming using advance functions. Introduction, CAPP Languages – APT, Exercises on part programming using APT.

### **RECOMMENDED BOOKS**

1. CNC Machines – Programming and Applications by M Adithan and BS Pabla; New Age International (P) Ltd., Delhi.
2. CNC Machine and Automation by JS Narang, Dhanpat Rai &Co, New Delhi.
3. Computer Aided Manufacturing by Rao, Kundra and Tiwari; Tata McGraw Hill, New Delhi.
4. CNC Machine by Bharaj; Satya Publications, New Delhi.

## **DME-305 MACHINE DRAWING**

### **UNIT-I**

**Shaft Couplings:** Oldham coupling, Universal coupling (Detail & Assembly Drawing)

**Bearings:** Bush bearing, Foot step bearing, Plummer block, Self aligning bearing & Brackets (Detail & Assembly Drawing)

### **UNIT-II**

**I.C. engine parts:** Piston, Connecting rod, Crankshaft and flywheel (Detail & Assembly Drawing)

**Gears:** Gear, Types of gears, Nomenclature of gears and conventional representation, Draw the actual profile of involute teeth of spur gear by different methods.

### **UNIT-III**

**Screw Jack & Machine Vice:** Detail & Assembly Drawing

**Pipe Joints:** Symbols for piping and layout plan of piping, Flanged joint, Socket and spigot joint, Union joint, Expansion pipe joint.

**Universal Joint:** Detail & Assembly Drawing

#### ***Recommended Books:***

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

# DME-306 ENGINEERING METALLURGY

## UNIT-I

**Transformations of Metals:** Introduction, Phase changes in steel, Phase changes in cast iron, ferrite, pearlite, cementite and austenite

Solidification of Metals: Introducing the C- curves, Concept of solidification, nucleation and growth.

## UNIT-II

**Non-equilibrium Transformations:** Concept of under cooling, Ingot structure and coring,

Pearlite, Bainite and martensite reactions, Mechanism of precipitation hardening, its process and application.

## UNIT-III

**Heat Treatment of Steels:** Austenitic grain growth grain size and effect on heat treatment,

Annealing, normalizing, hardening, tempering, spheroidising, austenitizing, stress relieving, TTT and CCT diagrams

**Case Hardening:** Introduction to case hardening, Advantages of case hardening & its methods, carburizing, nitriding, cyaniding, carbonitriding, and induction hardening.

## UNIT-IV

**Alloy Steels:** Industrial importance of alloys, types of cast iron and steels, the properties and applications of various types of cast iron and steels, coding of steel and other alloys as per industrial standards i.e- EN, ASME, BIS etc.

### ***Recommended Books:***

1. Engg. Phy. Metallurgy & Heat Treatment By Yuri Lakhtin, Mir Publishers
2. Physical Metallurgy by Donalk S Clark, East West Press
3. Material Science and Engineering by Raghvan, PHI
4. Material Science and Engineering by Srifastba, Wiley Eastern

# DME-401 STRENGTH OF MATERIALS

## UNIT-I

**Stresses and Strains:** Concept of load, stresses and strain, Tensile compressive and shear stresses and strains, Concept of Elasticity, Elastic limit and limit of proportionality, Hook's Law, Young Modulus of elasticity, Nominal stress, Yield point, plastic stage, Ultimate strength and breaking stress, Percentage elongation, Proof stress and working stress, Factor of safety, Shear modulus, Longitudinal and circumferential stresses in seamless thin walled cylindrical shells (without derivation)

**Resilience:** Resilience, proof resilience and modulus of resilience, Strain energy due to direct stresses, Stresses due to gradual, sudden and falling load.

## UNIT-II

**Moment of Inertia:** Concept of moment of inertia and second moment of area, Radius of gyration, Theorem of perpendicular axis and parallel axis (without derivation), Second moment of area of common geometrical sections :Rectangle, Triangle, Circle (without derivation); Second moment of area for L, T and I section, Section modulus.

**Bending Moment and Shearing Force:** Concept of beam and form of loading, Concept of end supports-Roller, hinged and fixed, Concept of bending moment and shearing force, B.M. and S.F. Diagram for cantilever and simply supported beams with and without overhang subjected to concentrated and U.D.L.

## UNIT-III

**Bending stresses:** Concept of Bending stresses, Theory of simple bending, Equation  $f/y = M/I = E/R$ , Concept of moment of resistance, Bending stress diagram, Calculation of maximum bending stress in beams of rectangular, circular, and T section, Permissible bending stress Section modulus for rectangular, circular and symmetrical I section.

**Columns:** Concept of column, modes of failure, Types of columns, Buckling load, crushing load, Slenderness ratio, Factors effecting strength of a column, End restraints, Effective length, Strength of column by Euler Formula without derivation, Rankine Gourdán formula (without derivation)

## UNIT-IV

**Torsion:** Concept of torsion- difference between torque and torsion, Use of torque equation for circular shaft, Comparison between solid and hollow shaft with regard to their strength and weight. Power transmitted by shaft, Concept of mean and maximum torque

**Springs:** Closed coil helical springs subjected to axial load and impact load, Stress deformation, Stiffness and angle of twist and strain energy, Proof resilience, Laminated spring (semi elliptical type only).

### **Recommended Books:**

1. SOM by Birinder Singh,; Katson Publishing House, New Delhi.
2. SOM by RS Khurmi; S.Chand & Co; New Delhi
3. Elements of SOM by D.R. Malhotra & H.C.Gupta; Satya Prakashan, New Delhi.

# DME-402 CAD/CAM/CIM

## UNIT-I

**Fundamentals of CAD/CAM:** Introduction to CAD/CAM, Types of Production Systems, The product cycle and CAD/CAM, Automation and CAD/CAM. The Design process, Applications of computers for design, Creating the manufacturing data base, Benefits of CAD.

Introduction to CIM Systems, Introduction of CIM, Concept of CIM, Evolution of CIM, CIM Components - Machine Tools and Related Equipment, Material Handling System, Computer Control System, Human Labor, CIM wheel, Benefits, Applications and Drawbacks of CIM.

## UNIT-II

**Computer Integrated Material Handling:** Introduction, Drawbacks of conventional material handling systems, Types, Automatic Guided Vehicle Systems(AGVS), Automatic Storage and Retrieval Systems (ASRS).

**Flexible Manufacturing Systems (FMS):** Product Development Cycle, Types of manufacturing systems, Introduction to FMS, FMS Tests, Types of FMS, FMS components, Workstations, Material handling systems, ASRS, Computer functions, FMS layouts, Manufacturing flexibility, Benefits, Applications and Drawbacks of FMS, Planning, design and operational Issues of FMS.

## UNIT-III

**Fundamentals of Industrial Robotic:** Introduction, Robot physical configurations, Basic Robot motions, Other technical features, Programming the robot, Robot programming languages, Robot Drives, End Effectors, Work cell control & Interlocks, Robot sensors, Robot Applications.

## UNIT-IV

**Essential CAD/CAM tools for CIM Systems:** Lean manufacturing, GT, CAPP, CAQC, SFC, ERP & MRPs, Introduction about CAD/CAM softwares.

### **Recommended Books:**

1. CAD/CAM/CIM , R.Radhakrishnan, S.Subramanian, New Age International Pvt. Ltd.
2. CAD/CAM , Mikell P.Groover, Emory Zimmers, Jr.Prentice Hall of India Pvt., Ltd.
3. CAD/CAM Principles & Applications, Dr.P.N.Rao, Tata Mc Graw Hill Publishing Company Ltd.
4. CAD/CAM, Ibrahim Zeid, Mastering Tata McGraw-Hill Publishing Company Ltd., New Delhi.
5. Automation, Production Systems, and Computer-Integrated Manufacturing, Mikell P. Groover, Pearson Education Asia.
6. Computer control of manufacturing systems, Yoram Koren, McGraw Hill Book.



# DME-403 FUNDAMENTALS OF THERMODYNAMICS

## UNIT-I

**Fundamental Concepts:** Thermodynamic state and system, boundary, surrounding, 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, Zeroth law of thermodynamics, definition of properties like pressure, volume, temperature, enthalpy and internal energy.

**Laws of Perfect Gases:** Definition of gases, explanation of perfect gas laws – Boyle's law, Charles's law, Avagadro's law, Regnault's law, Universal gas constant, Characteristic gas constants and its derivation. 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. Specific heat at constant pressure, specific heat at constant volume of a gas, derivation of an expression for specific heats with characteristics, simple numerical problems on gas equation.

## UNIT-II

**Thermodynamic Processes:** Types of thermodynamic processes – isochoric, isobaric, isothermal, adiabatic, isentropic, Polytropic and throttling processes, equations representing the processes, Derivation of work done, change in internal energy, change in entropy, rate of heat transfer for the above processes

**Laws of Thermodynamics:** Laws of conservation of energy, first law of thermodynamics (Joule's experiment) and its limitations, Application of first law of thermodynamics to Non-flow systems – Constant volume, Constant pressure, Adiabatic and polytropic processes, steady flow energy equation, Application of steady flow energy equation for turbines, pump, boilers, compressors, nozzles, and evaporators, Heat source and sink, statements of second laws of thermodynamics: Kelvin Planck's statement, Classius statement, equivalency of statements, Perpetual motion Machine of first kind, second kind, Carnot engine, Introduction of third law of thermodynamics, concept of irreversibility and concept of entropy, Principles of refrigeration and Air conditioning - Heat pumps - Vapor compression - Vapor absorption types - Coefficient of performance, Properties of refrigerants, Psychrometry.

## UNIT-III

**Internal Combustion Engines-** Introduction, Working principle of two stroke and four stroke cycle, SI engines and CI engines, Otto cycle, diesel cycle and dual cycle, Location and functions of various parts of IC engines and materials used for them, Fuel Supply and Ignition System in Petrol Engine: Concept of carburetion, Air fuel ratio.

Simple carburettor and its limitations and application, Description of petrol injection system. Fuel System of Diesel Engine: Components of fuel system, Description and working of fuel feed pump, Fuel injection pump, Common rail direct injection (CRDI), Firing Order.

## UNIT-IV

**Heat Transfer:** Modes of heat transfer-Conduction, Convection and Radiation. Heat transfer by conduction-Fourier law of heat transfer-Thermal conductivity of engineering materials-Heat conduction through plane wall-Heat conduction through composite wall-Simple problems. Newton's law of cooling-Stefan Boltzmann law of radiation. Heat exchanger-types, parallel flow heat exchanger, counter flow heat exchangers-Application of heat exchangers.

### **Recommended Books:**

1. Engineering Thermodynamics by PK Nag; Tata McGraw Hill, Delhi.
2. Basic Engineering Thermodynamics by Roy Chaudhary; Tata McGraw Hill, Delhi.
3. Engineering Thermodynamics by CP Arora; Tata McGraw Hill, Delhi.
4. Automobile engineering Vol. I by Dr. Kirpal Singh –Standard Publishers Distributors

## DME-404 TOOL DESIGN-I

### UNIT-I

**Fundamentals of Cutting Processes:** Introduction, Cutting/non-cutting operations, basic construction and parts, action of cutting/shearing, factors influencing cutting, clearance, angular clearance, stripping, cutting force, blank through dies.

### UNIT-II

**Blanking Dies:** Introduction, inverted dies, progressive dies, compound dies, die sets, guide pillars and bushes, classification of punches, types of die blocks, pilots, their function and types, stops, nest guides, strip layouts, factors influencing strip lay-outs.

### UNIT-III

**Bending Dies:** Definition, basic elements of a bend, bending stresses, plastic deformation, flat blank length estimation, bending force calculation, spring-back & its characteristics. "V" channel, wedge action, press breaks, spring-back correction methods in "V" dies. "U" bending dies, effect of pressure paid, correction of spring back in "U" dies types of "U" bending dies and construction of its parts, wiping dies and its types, curling dies, dies for making circular shapes.

#### ***Recommended Books:***

1. Fundamentals of Tool Design by JOHN NEE, Society of Manufacturing Engineers.
2. Tool Design by Donaldson , LeCain , Gould, McGraw-Hill Higher Education.

## DME-405 MOULD TECHNOLOGY- I

### UNIT-I

**Injection Mould and Moulding Process:** Injection Moulding Process, Injection Moulding Machine, Moulding Machine (Toggle clamping), Moulding Machine (Hydraulic clamping), Injection Moulding Machine/Mould relationship. Definition of terms related to Injection moulds: Cavity, Runner, Gate, Sprue Hole, Sprue hook/puller, Parting line, Shrinkage, Clamping Force.

### UNIT-I

**Construction of single cavity mould:** Cavity and Punch, Multi-cavity mould: arrangement of cavities, construction of a multi-cavity mould, typical four cavity layout, cavity disposition, layout with respect to balance and sprue hooks.

**Runners:** Hot runner, insulated runner.

### UNIT-III

**Gate:** Sprue gate, Edge gate, Diaphragm gate, Ring gate, Flash gate, Submarine gate, Pin Point gate.

**Parting Line:** Basic of Parting line and its different type of uses.

### UNIT-IV

**Ejector System:** Operation of ejector system, Centre ejection, Ejector system in the mould, Mechanical ejector system in the machine, Hydraulic ejector system in the machine, Air ejection, Chain ejection, Rod ejection, Ejection from injection side, Manual ejection.

**Ejectors:** Pin ejectors, Blade ejectors, Sleeve ejectors, Stripper Plate ejector, Disc ejector.

**Ejector Return Mechanism:** Pushbacks, Ejector return springs, Ejector return cams, Ejector return pushbacks.

### ***Recommended Books:***

1. Fundamentals of Plastic Mould Design by S. K. Nayak , P.C. Padhi , Y. Hidayatullah (Author) – Mc Graw Hill – Higher Education.
2. How to make Injection Moulds by Menges/Michaell/Mohren, Hanser Publishers, Munich.

# DEE-412 HYDRAULIC AND PNEUMATIC SYSTEMS

## UNIT-I

**Fluid Power, Pumps:** Fluid Power, Definition– Pascal's Law, Basic Properties Of Hydraulic Fluids- Mass, Weight, Density, Specific Weight, Specific Gravity, Viscosity, Bulk Modulus. Hydraulic Pumps-Classification, Pump Types, Piston Pumps –Axial and Radial Piston Pumps, Graphical Symbols and Working Principles only. Gear Pumps-External and Internal Gear Pumps, Graphical Symbols and Working Principles only. Vane Pump-Unbalanced and Balanced Vane Pump, Graphical Symbols and Working Principles only.

**Linear actuators, Rotary actuators:** Linear Actuators- Hydraulic Cylinders: Cylinder Types, Single Acting cylinder , Gravity Return cylinder, Spring Return cylinder, Telescopic Cylinder, Hydraulic Ram ,Tandem Cylinder, Symbols and working principles only. Rotary actuators, motor types, gear motor, balanced vane motor, piston motor, two vane rotor actuator-rack AND pinion rotary actuator-motor torque –speed –power –efficiency –symbols –applications –specifications.

## UNIT-II

**Directional control valve, pressure control valve, Flow control valve:** Directional Control Valves:-Check Valve-Shuttle Valves-Two Way Directional Control Valves -Three Way Directional Control Valves -Four Way Directional Control Valves – Directional Control Valves Actuation types-Symbols-Working Principles- Pressure Control Valve: Pilot Operated, Pressure Relief Valve – Pressure Reducing Valve –Sequence Valve – Symbols- Working Principles- Flow Control Valve – Type –Needle Valve –Pressure Compensated Flow Control Valve-Cushioned Cylinders –Flow Dividers –Balanced Spool Flow Divider-Rotary Flow Divider.

## UNIT-III

**Hydraulic components, Instrumentation and Measurement, Conduits and Fittings:** Hydraulic circuits: Hydraulic Components –Accumulators – types –Diaphragm - Spring Loaded -Weight Loaded -Pressure Intensifiers – Hydraulic Reservoirs-Heat Exchanger types- Air cooled –Water cooled-Filters. Instrumentation and Measurement: Pressure Gauges-Flow meters-Temperature Gauges-Conduits and Fittings: Pipe - Tubing –Hose - Seals and Bearings – Hydraulic Fluids. Hydraulic Circuits: Counter Balance Circuit –Sequence Circuit- Speed Control Circuit-Meter in Circuit –Meter out Circuit-Intermittent Feed Control-Speed Control for Continuous Processing – Booster and Intensifier Circuits-Force Multiplication – Pressure Intensification.

**Pneumatics system, Electronic control for Fluid power Pneumatics:** Basic principles of pneumatics-difference between hydraulics and pneumatics-compressor types-two stage piston compressor –rotary vane compressor-rotary screw compressor –vacuum pumps- double acting pneumatic cylinder–gear motor-pressure regulator –filters-lubricators-FRL unit-water removal – air preparation and distribution – Electronic control of fluid power -solenoid valves-servo valves pump controls.

## UNIT-IV

**Fundamentals of PLCs :** Introduction to PLCs, Areas of applications, Basic Design and Structure and Architecture of a typical PLC, Programming of PLCs, systematic solution finding, Programming languages, PLC Programmers, PC interface, Function block diagram, ladder diagram, instruction list, structured text 6. Sequential function chart, logic control systems, timers, counters,

Commissioning and operational safety of a PLC, data transmission interface and communication in the field area, Guidelines and standards.

***Recommended Books:***

1. Fluid Power Technology-Robert P. Kokernale-Library Of Congress Cataloging- Publication Data.
2. Basic Fluid Power - Dudley, A Pease and John J Pippenger - Prentice Hall 1987.
3. Fluid Power With Applications - Antony Esposito, Prentice Hall 1980.
4. Hydraulics And Pneumatics - (HB) Adrewparr –Jaico Publishing House.
5. Pneumatic And Hydraulic Systems - Bolton W. Butterworth-Heinemann-1987
6. Programmable Logic Controllers by Thomas E.Kissel
7. Programmable Logic Controller by Job Dan Otter; P.H. International Inc, USA

# DME-501 THEORY OF MACHINES

## UNIT-I

**Basic Concepts:** Definition of statics, kinetics, kinematics and dynamics, Rigid body and resistant body, Links, Kinematics pairs and their types, Degree of freedom, Kinematics chain and their types, Constrained motion and mechanisms, Classification of mechanisms, Equivalent mechanism, Laws of inversion of mechanisms, Single slider crank chain and its inversions, Quick return mechanism and IC engine mechanism, Double slider crank chain mechanism and its inversions like scotch yoke mechanism, Indicator mechanism, pantograph, Steering gear mechanism.

**Fly Wheel:** Functions of fly wheel, Kinetic Energy of rotating masses, turning moment diagram, Types of fly wheels, Co-efficient of energy & speed.

## UNIT-II

**Governor:** Functions of governor; comparison between a fly wheel and governor, Types of governor – Principle, construction and working of Watt governor Porter, governor, Hartnell governor, Simple problems on watt and porter Governor, Terminology used in Governors: Height, equilibrium speed, Hunting, isochronism, stability, sensitiveness.

**Cam:** Definition of cam, Classification of cams, Followers and their classification, Brief description of different types of cams and followers with simple line diagram, Simple cam profile for uniform velocity, SHM and uniform acceleration and deceleration with Flat, knife edge and roller type follower.

## UNIT-III

**Power Transmission Devices (Belt, Rope and Chain Drive):** Introduction, Belt and rope drives, open and crossed belt drives, actions of belt on pulleys, velocity ratio, Material for belts and ropes, Slip in belts & ropes, Types of V Belt and Flat belt, Types of pulleys – step pulley, flat pulley, Crowning in pulley, Laws of belting and length of belt (open & cross belt), Ratio of tensions, Power transmitted and max power transmitted by belt, Centrifugal effect on belt, Initial tension, Chain drive, classification of chains, Selection of rope based on the load to be lifted, Gear Drive - Simple, compound, reverted and epicyclic gear trains (simple numericals)

**Friction & Clutches:** Frictional torque in screws for both square and V-threads, Screw jack, Calculation of power required for raising a load, Friction in collars & pivots, Friction in plate clutch & conical clutch, Different types of bearings & their applications, Derivation of formula for torque wasted in friction bearing and torque transmission capacity of clutches.

## UNIT-IV

**Balancing & Vibrations:** Need of balancing, Concept of static and dynamic balancing, Balancing of rotating mass by another mass in the same plane, Concept of reference plane, Simple problems pertaining to several masses rotating in different planes, Types of vibration – longitudinal, transverse and torsional vibration Causes, remedial measures & harmful effects of vibrations

### **Recommended Books:**

1. JS Rao and Dukkipati; Mechanism and Machine Theory; Wiley Eastern, New Delhi
2. A Ghosh and AK Malik: Theory of Mechanism and Machine; East West Press (Pvt) Ltd., New Delhi
3. MF Spotts: Design of Machine Elements; Prentice Hall of India Ltd., New Delhi
4. R.C Jindal; Theory of Machines & Mechanisms; Ishan Publications, Ambala City
5. S.S Rattan: Theory of Machines; Tata McGrawHill, New Delhi

# DME-502 MACHINE DESIGN

## UNIT-I

**Introduction:** Design - Definition, types of designs necessity of design, Comparison of designed and undersigned work, Design procedure, Characteristics of a good designer, Characteristics of environment required for a designer, 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, Codes and standards.

Engineering materials and their mechanical properties: Properties of engineering materials: elasticity, plasticity, malleability, ductility, toughness, hardness and resilience. Fatigue, creep, tenacity, strength, Selection of materials, criterion of material selection.

**Design Failure:** Various design failures-maximum stress theory, maximum strain theory, Classification of loads, Design under tensile, compressive and torsional loads.

## UNIT-II

**Design of Shaft:** Type of shaft, shaft materials, Type of loading on shaft, standard sizes of shaft available, Shaft subjected to torsion only, determination of shaft diameter (hollow and solid shaft) on the basis of :Strength criterion, Rigidity criterion, Subjected to bending, Combined torsion and bending.

**Design of Key:** Types of key, materials of key, functions of key, Failure of key (by Shearing and Crushing), Design of key (Determination of key dimension),Effect of keyway on shaft strength. Numerical Problems.

## UNIT-III

**Design of Joints:** Types of joints - Temporary and permanent joints, utility of various joints, Temporary Joint: Knuckle Joints – Different parts of the joint, material used for the joint, type of knuckle Joint, design of the knuckle joint. Cotter Joint – Different parts of the spigot and socket joints, Design of spigot and socket joint.

Permanent Joint: Welded Joint - Welding symbols. Type of welded joint, strength of parallel and transverse fillet welds. Strength of combined parallel and transverse weld, Riveted Joints. : Rivet materials, Rivet heads, leak proofing of riveted joint – caulking and fullering. Different modes of rivet joint failure, Design of riveted joint – Lap and butt, single and multi riveted joint, Design of boiler joints i.e. circumferential and longitudinal boiler joints.

## UNIT-IV

**Design of Couplings:** Necessity of a coupling, advantages of a coupling, Types of couplings, Design of muff coupling, Design of flange coupling (Both protected type and unprotected type).

**Design of Screwed Joints:** Introduction, Advantages and Disadvantages of screw joints, location of screw joints, Important terms used in screw threads, designation of screw threads,Initial stresses due to screw up forces, stresses due to combined forces,Design of power screws (Press, screw jack, screw clamp)

### **Recommended Books:**

1. Machine Design by Sharma and Aggarwal; Katson Publishing House, Ludhiana.
2. Machine Design by R.S. Khurmi & J.K. Gupta; Eurasia Publishing House (Pvt.) Ltd.
3. Design of Machine elements by V.B. Bhandari; Tata Mc Graw Hill; Delhi.
4. Engineering Design by George Dieter; Tata Mc Graw Hill; Delhi.
5. Mechanical Engineering Design by Joseph Edward Shigley, Mc Graw Hill.
6. Machine Design by Sadhu Singh.
7. Machine Design by G.R. Nagpal.
8. Machine Design by A.P.Verma; SK Kataria and Sons, Delhi
9. Machine Design by G.S. Aulakh; Eagle Prakashan, Jalandhar
10. Machine Design Data Book.

# DME-503 FLUID MECHANICS & MACHINERY

## UNIT-I

**Introduction** :Introduction to Hydraulics and Pneumatics. Fluid, types of fluid; properties of fluid viz mass density, weight density (specific weight), specific volume, capillarity, specific gravity, viscosity, compressibility, surface tension, kinematic viscosity and dynamic viscosity and their units. Simple numeric problems related to properties of fluids.

### Pressure and its Measurement

Concept of pressure, Intensity of pressure, static pressure and pressure head. Types of Pressure (Atmospheric Pressure, Gauge Pressure, Absolute Pressure).

Manometers: Piezometer, Simple U- tube Manometer, Micromanometer, Differential U-tube Manometer, Inverted U-tube, Manometers Construction, working and application , including simple numerical problems.

Mechanical Gauges: Bourdon Tube pressure gauge, Diaphragm Pressure Gauge, Dead weight pressure gauge. Construction, working and application.

Statement of Pascal's law and its applications.

## UNIT-II

**Flow of Fluids**: Types of fluid flow – Steady and Unsteady, Uniform and Non-uniform, Laminar and Turbulent; Rate of flow (Discharge) and its units; Continuity Equation of Flow; Hydraulic Energy of a flowing fluid ; Total head ; Bernoulli's Theorem statement (without proof ) and its applications. Discharge measurement with the help of Venturimeter, Orifice meter, Pitot-tube, limitations of Bernoulli's theorem, simple numerical problems on above topics.

Pipe and 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 (without proof), Reynold's number and its effect on pipe friction; Water hammer. Simple numerical problems on pipe friction.

Nozzle - definition, velocity of liquid flowing through the nozzle, power developed.

## UNIT-III

**Hydraulic Machines**: Description, operation and application of – hydraulic press, hydraulic jack, hydraulic accumulator, hydraulic brake ,hydraulic ram, hydraulic door closer. Pumps and Water Turbines, Concept of hydraulic pump.

Classification of pumps. Construction, operation and application of Single acting reciprocating pump, vane, screw and gear pumps. Construction, operation and application of centrifugal pump.Troubleshooting and problems in centrifugal pumps and remedial measures, pitting, cavitation, priming.

Concept of a turbine, classification of turbines, types of turbines - impulse and reaction type (concept only), difference between them. Construction and working of pelton wheel, Francis turbine and Kaplan turbines.

## UNIT-IV

### Oil Power Hydraulic and Pneumatic systems

Introduction to oil power hydraulics and pneumatic system. Relative Merits and Demerits as oil power hydraulic and pneumatic system.

Industrial applications of oil power hydraulic and pneumatic system.

Basic components of hydraulic system, definition and functions of each component in a hydraulic circuit. Hydraulic oils- Classification and their properties. Seals and packing-classification of seals, sealing materials.



Maintenance of hydraulic system: common faults in hydraulic system, simple visual checks of oil, causes of contamination, preventive measures.

Basic Components of Pneumatic Systems, definition and functions of each component in a Pneumatic circuit. Necessity of Filter, Regulator and Regulator (FLR).

Common problems in pneumatic systems. Maintenance schedule of pneumatic systems.

### **RECOMMENDED BOOKS**

1. Fluid Mechanics by KL Kumar; S Chand and Co Ltd., Ram Nagar, New Delhi.
2. Hydraulics and Fluid Mechanics Machine by RS Khurmi ; S.Chand & Co. Ltd., New Delhi.
3. Fluid Mechanics through Problems by RJ Garde; Wiley Eastern Ltd., New Delhi.
4. Fluid Mechanics by Dr AK Jain, Khanna Publishers, New Delhi.
5. Hydraulic and Pneumatic Control by K Shammuga Sundaram, S. Chand & Co. Ltd., New Delhi
5. Hydraulics and Hydraulic Machinery by Dr. Jagadish Lal; Metropolitan Book Company Ltd., Delhi.
6. Hydraulic and Pneumatic Power and Control Design, Performance and Application by Yeaple, McGraw Hill, New York..
8. Pneumatic Controls by Festo Didactic; Bangalore.
9. Pneumatics Control: An Introduction to the Principles by Werner Deppert and Kurt Stoll;Vogel – Verlag.

# DME- 504 JIGS & FIXTURES

## UNIT-I

**Jigs and Fixtures:** Concept of jigs & fixtures, need and advantages, concept of interchangeability, classification of jigs & fixtures.

**Location and Clamping devices:** Basic principles of location, 3-2-1 principle of location, location for various services, location methods and devices. Concept of clamping and various clamping devices.

## UNIT-II

**Drilling Jigs:** Definition of a drilling jig. Drilling jig. Drilling bushes & their function. Types of drilling jigs such as box type, channel jig, latch jig, indexing jig.

**Fixtures:** Introduction to fixtures, types of fixtures such as milling fixture (single piece, gang milling) lathe and boring fixtures, grinding and welding fixture. Application of pneumatic in jigs and fixtures.

## UNIT-III

**Limit gauges:** Introduction to plain limit gauges, classification of limit gauges such as plug, ring & snap gauges. Brief description of thread gauges. Material selection. Taylor's principle of maximum & minimum material condition. Go and not-go ends of gauges and selection of gauge for inspection.

## UNIT-IV

Design, Drawing & Practice of Jig, fixtures & Gauge

Design and drawing of drilling jigs (at least 2 sheets)

Design and drawing of fixtures for milling (at least 2 sheets)

Design and drawing of limit gauges such as plug, ring and snap gauge (at least 1 each).

### **Recommended Books:**

1. Prakash H Joshi, Press tools design & construction, Wheeler Publisher.
2. Donaldson, Fundamental of tool design.
3. Surrender Kr & Umesh Chandra, Production Engg. & Design, Satya Parkashan, New Delhi.
4. D. Engene Ostergard, Basic Die Making; Mc Graw Hill Book Co.
5. ASTME, "Fundamentals of Tool Design".
6. Handbook of Fixture Design, by Frank W. Wilson; McGraw Hill Book Company.

## DME- 505 TOOL DESIGN-II

### UNIT-I

**Fine Blanking Dies:** Introduction, conventional blanking versus fine blanking, application of fine blanked components, construction of fine blanking tool and its parts, fine blanking tool with moving punch, fine blanking tool with fixed punch.

### UNIT-II

**Design of Punches:** Details of types of punches, punch guiding plate ("V" ring), ejectors, slug ejector, blank ejector, fine blanking press, Design preparations such as "V" ring pressure, cutting clearance, die clearance, stock material, hints on component design, trouble shooting.

### UNIT-III

**Deep Drawing Dies:** Introduction, definitions, stresses in drawing, plastic deformation in drawing, basic construction of a draw die, factors influencing drawing, blank holding pressure, drawing speed, types of processes, types of drawing dies, die parts viz.; punches, dies, blank holders. Redrawing, blank size estimation methods & examples.

#### ***Recommended Books:***

1. Fundamentals of Tool Design by JOHN NEE, Society of Manufacturing Engineers.
2. Tool Design by Donaldson , LeCain , Goold, McGraw-Hill Higher Education.

## DME-506 MOULD TECHNOLOGY-II

### UNIT-I

**Split Moulds:** Splits operated by inclined pillars, Components with undercuts, Inclined pillar and slider operating cycle, Slider guiding system, Slider layouts, Moulds operated by Inclined pillars and sliders, Sliders operated by delayed action finger cams, Follow split mould, Splits operated by ejector system, Portable split mould.

**Moulding of internal threaded components:** Manual unscrewing, Unscrewing with rack and pinion, Locking while unscrewing, Rack and Pinion system, Chain drive, Gear train drive, motor drive, Coarse spiral drive system.

### UNIT-II

**Mould Cooling:** Linier and copper tube cooling, simple cooling, Spiral layout and straight layout of waterways, cooling with inserts, Simple/Core cooling, Cooling of cores.

**Three Plate Mould:** Construction of a three plate mould, Working of a three plate mould, Three plate mould (multi-point feeding and sliders), Locking unit for three plate mould.

**Mould Alignment, Ventilation & Air vents:** Mould alignment with taper matching, Moulding deep components (taper matching).

**Trouble Shooting:** Components cannot be released, incomplete cavity filling, twisted component, Surface Finish problem, Shrink marks on the components.

### UNIT-III

**Mould Design & Materials:** Low carbon steels, Case carburizing alloy steels, Nickel Chromium Molybdenum steel, Stainless steels, Pre-hardened steels.

**Rotational Moulding:** Introduction, The process, Advantages, disadvantages, Applications.

**Blow Moulding Process:** Basic Blow moulding process, Injection blow moulding, Extrusion blow moulding, Stretch blow moulding, Extrusion stretch blow moulding, Polymers used for blow moulding process, Requirements for blow moulding materials, Selection of materials for packaging application, Why polypropylene for blow moulding.

**Thermoforming:** Introduction, Different types of thermoforming process: Vacuum forming, Pressure forming, Matched die forming, Straight vacuum forming, Drape vacuum forming, Force above sheet, Plug and Ring forming, Materials used in thermoforming process, Applications, Advantages and disadvantages.

### UNIT-IV

**Extrusion:** Introduction of extrusion, Defects of extrusion.

**Compression moulding:** Definition, Flow chart, Process, Compression moulding machine, Different materials for compression moulding.

**Transfer moulding:** Process of ram injection moulding of thermosets, Horizontal transfer moulding, Screw injection moulding of thermosets, Work cycle of transfer mould.

**Calendaring:** Introduction, Different types of calendaring, Arrangement of calendar rolls, Inverted L-type arrangement of calendar rolls.

#### **Recommended Books:**

1. Fundamentals of Plastic Mould Design by S. K. Nayak , P.C. Padhi , Y. Hidayatullah (Author) – Mc Graw Hill – Higher Education.
2. How to make Injection Moulds by Menges/Michaell/Mohren, Hanser Publishers, Munich.

# DME- 601 INDUSTRIAL ENGINEERING AND MANAGEMENT

## UNIT-I

**Plant Engineering and Plant Safety:** Plant Engineering : Plant – Selection of site of industry – Plant layout – Principles of a good layout – types – process, product and fixed position – techniques to improve layout – Principles of material handling equipment – Plant maintenance – importance – Break down maintenance, preventive maintenance and scheduled maintenance. Plant Safety: Importance –accident-causes and cost of an accident-accident proneness-prevention of accidents-Industrial disputes-settlement of Industrial disputes-Collective bargaining, conciliation, Mediation, arbitration-Indian Factories Act 1948 and its provisions related to health, welfare and safety.

## UNIT-II

### **Work Study, Method Study and Work Measurement:**

Work Study: Productivity – Standard of living – method of improving productivity – Objectives – Importance of good working conditions.

Method Study: Definition – Objectives – Selection of a job for method study – Basic procedure for conduct of method study – Tools used – Operation process chart, Flow process chart, two handed process chart, Man machine chart, String diagram and flow diagram.

Work Measurement: Definition – Basic procedure in making a time study – Employees rating factor – Application of time allowances – Rest, Personal, Special and Policy allowances – Calculation of standard time – Problems – Basic concept of production study – Techniques of work measurement- Ratio delay study, Synthesis from standard data, analytical estimating and Pre determined Motion Time System (PMTS).

## UNIT-III

**Accidents and Safety:** Classification of accidents; according to nature of injuries i.e. fatal, temporary; according to event and according to place, Causes of accidents-psychological, physiological and other industrial hazards, Effects of accidents, Accidents-prone workers. Action to be taken in case of accident with machines, electric shock, road accident, fires and erection and construction accidents, Safety consciousness & publicity, Safety procedures, Safety measures-Do's and don'ts & good housekeeping (5S), Safety measures during executions of Electrical Engineering works.

**Material and Maintenance Management:** Material management: Objectives of good stock control system – ABC analysis of inventory – Procurement and consumption cycle – Minimum Stock, Lead Time, Reorder Level-Economic order quantity problems – supply chain management – Introduction – Purchasing procedure – Store keeping, Maintenance Management: Concept, Types of Maintenance.

### **Recommended Books:**

1. Industrial Engineering by O.P. Khanna; Dhanpat Rai and Sons, New Delhi.
2. Industrial Engineering by S.C. Sharma; Khanna Publisher.
3. Industrial Engineering and Management by T.R. Banga.
4. Production Management by Jain and Aggarwal.
5. Industrial Management by VK Sharma, OP Harkut.
6. Principles of Management by Philip Kotler, TEE Publication.
7. Industrial Organisation and Management by Tara Chand, Nem Chand and Brothers, Roorkee

# DME- 602 INSPECTION AND QUALITY CONTROL

## UNIT-I

**Inspection:** Introduction, units of measurement, standards for measurement and interchangeability. International, national and company standard, line and wavelength standards. Limits fits and tolerances: study of natural variability of process. Indian standards on limits, fits and tolerances including terminology, guide for selection of fits, clearance, transition and interference. Positional tolerances: maximum material condition usage of standards for deciding tolerance. Planning of inspection: what to inspect? When to inspect? Who should inspect? Where to inspect? Types of inspection: remedial, preventive and operative inspection, incoming, inprocess and final inspection. Study of factors influencing the quality of manufacture.

## UNIT-II

**Measurement and Gauging:** Basic principles used in measurement and gauging, mechanical, optical, electrical and electronic. Study of various measuring instruments like: calipers, micrometers, dial indicators, surface plate, straight edge, try square, protectors, sine bar, clinometer, comparators – mechanical, electrical and pneumatic. Slip gauges, tool room microscope, and profile projector, talysurf. Limit gauges: plug, ring, snap, taper, thread, height, depth, form, feeler, wire and their applications for linear, angular, surface, thread and gear measurements, gauge tolerances. Geometrical parameters & errors: Errors & their effect on quality, concept of errors, measurement of geometrical parameter such as straightness, flatness & parallelism. Study of procedure for alignment tests on lathes, drilling and milling machines. Testing and maintenance of measuring instruments.

## UNIT-III

**Statistical Quality Control:** Basic statistical concepts, empirical distribution and histograms, frequency, mean, mode, standard deviation, normal distribution, binomial and Poisson (No mathematical derivations). Introduction to control charts, namely X, R, P and C charts and their applications, Sampling plans, selection of sample size, method of taking samples, frequency of samples. Inspection plan format and test reports Concept of total quality management (TQM).

## UNIT-IV

**Standards and Codes:** National and International Codes. ISO-9000, concept and its evolution and implications.

**Instrumentation:** Measurement of mechanical quantities such as displacement, vibration, frequency, pressure temperature, humidity by electro mechanical transducers of resistance, capacitance & inductance type.

### **Recommended Books:**

1. Statistical Quality Control by M.Mahajan: Dhanpat Rai and Sons, Delhi
2. Engineering Metrology by RK Jain
3. Engineering Metrology by RK Rajput; SK Kataria and Sons
4. Production Planning Control and Management by KC Jain & Aggarwal; Khanna Publishers, New Delhi

## **DME-603 ENTREPRENEURSHIP DEVELOPMENT AND MANAGEMENT**

### **UNIT-I**

**Entrepreneur & Entrepreneurship:** Definitions, Aspects of Entrepreneurship, Characteristics, Myths & Challenges of Entrepreneurship, Case Studies of Successful Entrepreneurs.

### **UNIT-II**

**Entrepreneurial Anatomy:** Starting a new company, Creating a business plan, making a product choice, setting up infrastructure, Naming & Registering Business, Selection of form of Business Organization, Selection of Site, Product identification & Pricing, Regulatory Requirements, Financing, Sourcing of Raw Materials, Setting up Machinery & Equipment, Hiring Human Resources.

### **UNIT-III**

**Innovation & Creativity :** Definitions, Sources of Innovation Opportunity, Principles of Innovation, Innovation Process, Type of Innovation, Creative Process, Developing Creativity, Adoptors Innovator, Left Brain vs. Right Brain, Purposeful Innovation & 7 Sources of Innovation Opportunity.

### **UNIT-IV**

**Intellectual Property Rights:** Introduction, Need, Type of IPR, Patents, Copyright & Related Rights, Trademark, Industrial Design, Geographical Indications, Layout Design of Integrated Circuits, Plant Varieties Protection & Trade Secret.

**Principles of Management:** Basic Concepts of Management, Functions of Management, Leadership & its aspects.

### ***Recommended Books:***

1. A Handbook of Entrepreneurship, Edited by BS Rathore and Dr JS Saini; Aapga Publications, Panchkula (Haryana)
2. Entrepreneurship Development by CB Gupta and P Srinivasan, Sultan Chand and Sons, New Delhi
3. Environmental Engineering and Management by Suresh K Dhamija, SK Kataria and Sons, New Delhi
4. Environmental and Pollution Awareness by Sharma BR, Satya Prakashan , New Delhi
5. Thakur Kailash, Environmental Protection Law and policy in India: Deep and Deep Publications, New Delhi
6. Handbook of Small Scale Industry by PM Bhandari
7. Marketing Management by Philip Kotler, Prentice Hall of India, New Delhi
8. Total Quality Management by Dr DD Sharma, Sultan Chand and Sons, New Delhi.
9. Principles of Management by Philip Kotler TEE Publication

# DME-604 MACHINE TOOL DESIGN

## UNIT-I

**Drives:** Design considerations for drives based on continuous and intermittent requirement of power, Types and selection of motor for the drive, Regulation and range of speed based on preferred number series, geometric progression. Design of speed gear box for spindle drive and feed gear box.

## UNIT-II

### **Design of Machine Tool Structure:**

Analysis of forces on machine tool structure, static and dynamic stiffness. Design of beds, columns, housings, bases and tables.

### **Design of Guide-ways:**

Functions and types of guide-ways, design criteria and calculation for slide-ways, design of hydrodynamic, hydrostatic and aerostatic slide-ways, Stick-Slip motion in slide-ways.

## UNIT-III

### **Design of Spindles, Spindle Supports and Power Screws:**

Design of spindle and spindle support using deflection and rigidity analysis, analysis of antifriction bearings, preloading of antifriction bearing, Design of power screws: Distribution of load and rigidity analysis.

**Dynamics of machine tools:** Dynamic characteristic of the cutting process, Stability analysis, vibrations of machine tools. Control Systems, Mechanical and Electrical, Adaptive Control System, relays, push button control, electrical brakes, drum control.

## UNIT-IV

### **Special features in Machine Tool Design :**

Design considerations for SPM, NC/CNC, and micro machining, Retrofitting, Recent trends in machine tools, Design Layout of machine tool using matrices.

Step-less drives Design considerations of Step-less drives, electromechanical system of regulation, friction, and ball variators, PIV drive, Epicyclic drive, principle of self locking,

### **Recommended Books:**

1. N.K. Mehta, "Machine Tool Design", Tata McGraw Hill
2. Bhattacharya and S. G. Sen., "Principles of Machine Tool", New central book agency Calcutta
3. D. K Pal, S. K. Basu, "Design of Machine Tool", 4th Edition. Oxford IBH 2005
4. N. S. Acherkan, "Machine Tool", Vol. I, II, III and IV, MIR publications.



## DME- 605 PRODUCTION PLANNING AND CONTROL

### UNIT-I

**Production Planning and Control** Production and Productivity: Production, production functions, productivity, factors affecting productivity, measurement of productivity, causes of decrease in productivity, difference between production and productivity.

Production Planning and Control: Introduction – Major functions of production planning and control – Pre planning – Methods of forecasting – Routing and scheduling – Dispatching and controlling – Concept of Critical Path Method (CPM)-Description only. Production – types-Mass production, batch production and job order production- Characteristics – Economic Batch Quantity (EBQ) – Principles of product and process planning – make or buy decision – problems.

**Job Evaluation and Incentives:** Introduction, objectives, needs of job evaluation, job definition, job analysis, data source, job evaluation methods such as ranking method, grade description method, point system and factor comparison method, hybrid system. Incentive-definition and concept, types of incentives such as financial, non financial.

**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.

Modern Management Techniques: JIT, TQM, Quality Circle, Zero Defect Concept, 5S, MIS

#### **Recommended Books:**

1. Industrial Engineering by O.P. Khanna; Dhanpat Rai and Sons, New Delhi.
2. Industrial Engineering by S.C. Sharma; Khanna Publisher.
3. Industrial Engineering and Management by T.R. Banga.
4. Production Management by Jain and Aggarwal.
5. Industrial Management by VK Sharma, OP Harkut.
6. Principles of Management by Philip Kotler, TEE Publication.
7. Industrial Organisation and Management by Tara Chand, Nem Chand and Brothers, Roorkee

# DDI-606 INNOVATION, DESIGN & MANUFACTURING

## UNIT-I

**Introduction:** Need for innovation and design, Classification/ Specifications of Products, Product life cycle. Product mix, Introduction to product design, Modern product development processes, Difference between Product development and product design, Innovative thinking, Morphology of design.

## UNIT-II

**Conceptual Design:** Generation, selection & embodiment of concept, Need of Problem Identification, Product architecture, Industrial design: process & need, User study by contextual enquiry, Questionnaire study, Interview techniques, Persona and scenario mapping, Product Study and market study, Design Brief

**Design for Mfg & Assembly:** Methods of designing for Mfg & Assy., Designs for Maintainability, Designs for Environment, Product costing, Legal factors and social issues, Engg ethics and issues of society related to design of products, Importance of Human factors in product design, Physical Ergonomics principles and issues, Ergonomic assessment tool, Cognitive issues in product design

## UNIT-III

**Value Engineering / Value Analysis:** Definition. Methodology, Case studies, Economic analysis: Qualitative & Quantitative, Ergonomics / Aesthetics: Gross human autonomy, Anthropometry, Man-Machine interaction, Concepts of size and texture, colour .Comfort criteria, Psychological & Physiological considerations, Creativity Techniques: Creative thinking, conceptualization, brain storming, primary design, drawing, simulation, detailed design & Design optimization.

## UNIT-IV

**Creative techniques and tools:** for Concept generation, concept evaluation, Tools for product design – Drafting / modeling software, Product prototyping model making work flow, tools and techniques for model making and prototyping, introduction to prototype driven innovation, Overview of materials and processes, Evaluation tools and techniques for User- Product interaction

### **Recommended Books:**

1. Karl T Ulrich, Steven D Eppinger, “ Product Design & Development.” Tata McGrawhill New Delhi 2003
2. Kevin Otto & Kristin Wood Product Design: “Techniques in Reverse Engineering and new Product Development.” 1 / e 2004, Pearson Education New Delhi
3. L D Miles “Value Engineering.”
4. Hollins B & Pugh S “Successful Product Design.” Butter worths London.
5. Jones J C “Design Methods.” Seeds of Human Futures. John Willey New York.
6. Bralla J G “Handbook of Product Design for Manufacture, McGrawhill NewYork
7. Eppinger, S., & Ulrich, K. (2015). Product design and development. McGraw-Hill Higher Education.
8. Green, W., & Jordan, P. W. (Eds.). (1999). Human factors in product design: current practice and future trends. CRC Press.
9. Roozenburg, N. F., & Eekels, J. (1995). Product design: fundamentals and methods (Vol. 2). John Wiley & Sons Inc.

## **DME-701 DESIGN OF FINE BLANKING DIES**

Introduction, Conventional blanking versus fine blanking, application of fine blanked components, Construction of fine blanking tool and its parts, Fine blanking tool with moving punch, Fine blanking tool with moving punch, Fine blanking tool with fixed punch, Design details of types of punches, Punch guiding plate ("V" Ring), Ejectors- Slug ejectors, Blank ejectors, Fine Blanking press, Design preparations such as "V" ring pressure, Cutting Clearance, Die Clearance, Stock material, Hints on component design, troubleshooting.

### ***Recommended Books:***

1. Fundamentals of Tool Design by JOHN NEE, Society of Manufacturing Engineers.
2. Tool Design by Donaldson , LeCain , Goold, McGraw-Hill Higher Education.

# DME-702 PLASTIC TECHNOLOGY

## UNIT -I

Polymers: Introduction, characteristics of polymer, classification of polymer, molecular structure, polymerization, polymer processing, copolymer, polymer crystalline, Fibers, Miscellaneous applications of polymers, cross-linking of polymers, behavior of polymers, Effect of polymer structure on properties, Anelasticity, viscoelasticity

## UNIT -II

Elastomers (Rubber): Introduction, characteristics of Rubbers, structure of rubbers, properties of elastomer, types of elastomer, vulcanization of rubber, forming and fabrication techniques of rubber, uses of rubber, typical application of elastomers,

Plastic Materials: Introduction, Definition and concept, properties of plastics, , types of plastics, plastics forming and fabricating, plastics moulding processes, Deformation of plastics, plastics Alloys.

## UNIT -III

Adhesives: : Introduction, adhesion process Types of adhesives, Bonding methods, some special adhesives and seals, pressure sensitive adhesives, and types, conductive adhesives, Epoxy resins, advantages and disadvantages of adhesives, Application of adhesives bonding,

Miscellaneous Materials: Introduction composite materials, fibers , glass wool, ceramic,

Bio-degradable plastics and Bio plastics:- source, types, overview of plastics, degradation- Natural Bio-degradable polymers , synthetic Bio-degradable polymers, water soluble polymers.

Opto –Electronics Plastics: introduction, types, application process, new materials introduce such as conducting materials, future.

## UNIT -IV

TESTING OF PLASTICS: Concepts of Testing & Identification of Plastics Basic concepts of testing - Specification and Standards - National and International Standards - Test specimen preparation - Pre-conditioning and test atmosphere. Identification of plastics by simple tests - Visual examination - Density - Melting point - Solubility test - Flame test - Chemical tests, Density by Density-gradient column Particle size by sieve analysis and moisture content analysis.

Mechanical Tests, Thermal Tests, Chemical Tests, Electrical & Optical Tests, Weathering Tests

## UNIT -V

Plastics Recycling and Waste Management: Introduction – Sources of Plastics Waste – Collection of Plastics Waste – Sorting and segregation methods viz. simple identification techniques, Density Separation, Solvent Separation, floatation technique, Air classification, Melt filtration and Equipment based sorting techniques

## RECOMMENDED BOOKS

1. J.A.Brydson,PlasticsMaterials,ButterworthHeinemannOxford,1999.
2. CharlesA.Harper,ModernPlasticsHandBook,McGraw-Hill,NewYork,1999.
3. H.Domininghaus,PlasticsforEngineers,HanserPublishers,Munich-1988.
4. W.D. Callister, Jr, - Material Science & Engineering Addition-Wesly Publishing Co.
5. Van Vlash - Elements of Material Science & Engineering John Wiley & Sons.

# **DEE 703- EMERGING TECHNOLOGIES-I**

## **UNIT -I**

Image Processing Applied to Mechatronics Systems: Introduction to image processing, types of images, concept of spatial and frequency domain, Image enhancement, spatial domain and frequency domain methods, enhancement by point frequency, special filtering, enhancement in frequency domain, color image frequency. Texture Feature Extraction: Concept of texture, Feature extraction methods in spatial domain: Gray level co-occurrence matrix, Gray level run length matrix, Laws' mask analysis Feature extraction in frequency domain. Mechatronics Applications of Image Processing

## **UNIT -II**

MEMs Systems: Introduction to MEMs, MEMs Sensors and Actuators, Comparison with VLSI based Ckts. Microfabrication Techniques.

## **UNIT -III**

Introduction to Additive Manufacturing (AM) - Reverse engineering, Different AM processes and relevant process physics, AM process chain, Application-level: Direct processes – Rapid Prototyping, Rapid Tooling. Rapid Manufacturing; Indirect Processes - Indirect Prototyping. Indirect Tooling, Indirect Manufacturing, AM technologies - Powder-based, droplet-based, extrusion-based, object stereolithography, Micro- and nano-additive processes.

## **DME-801 DESIGN OF DIE CASTING DIES**

Introduction, Gravity die casting dies, process of gravity casting, Main parts of die casting machine, Pressure die casting dies, Main parts of the die casting machine, Pressure die casting: Main parts of the die, Parting Line, runners, gates, ejectors, cores, vents, shrinkages, cooling methods, location and guidance, die materials, Casting materials.

### ***Recommended Books:***

1. Fundamentals of Tool Design by JOHN NEE, Society of Manufacturing Engineers.
2. Tool Design by Donaldson , LeCain , Goold, McGraw-Hill Higher Education.

## **DME-802 DESIGN OF DEEP DRAWING DIES**

Introduction, Definitions, Stresses in drawing, plastic deformation in drawing, Basic construction of a draw die, factors influencing drawing blank, holding pressure, drawing speed, types of processes, types of drawing dies, die parts viz.; Punches, Dies, Blank Holders. Redrawing blank size estimation methods & examples.

### ***Recommended Books:***

1. Fundamentals of Tool Design by JOHN NEE, Society of Manufacturing Engineers.
2. Tool Design by Donaldson , LeCain , Goold, McGraw-Hill Higher Education.

## **DEE-803 EMERGING TECHNOLOGIES- II**

### **UNIT -I**

Machine Learning & Deep Learning: Overview of Machine learning concepts – Over fitting and train/test splits, Types of Machine learning – Supervised, Unsupervised, Reinforced learning, kNN Classifier, Neural Network Classifier, Introduction to Python Programming, Basic of Machine Learning and Deep Learning, Structure and function of a single neuron, Artificial neuron models, Types of activation functions, Neural network architectures, Back propagation algorithm, Application of neural networks for Classification, Serial and DAG Deep learning architectures, Convolution layer, Activation, Pooling. Case studies.

### **UNIT -II**

IoT and Its Applications: Introduction to IoT, Architectural Overview, Design principles and needed capabilities, IoT Applications, Sensing, Actuation, Basics of Networking, M2M and IoT Technology Fundamentals- Devices and gateways, Data management, Business processes in IoT, Everything as a Service(XaaS), Role of Cloud in IoT, Security aspects in IoT.

### **UNIT -III**

Industry 4.0: Introduction to Industry 4.0 standards