



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



# **CURRICULAM & EVALUATION SCHEME OF**

**Three Years Diploma in Electronics Engineering**

**AND**

**Four Years Advanced Diploma in Mechatronics &  
Industrial Automation**

## DIPLOMA IN ELECTRONICS ENGINEERING

### FIRST SEMESTER

SUBJECT CODE	SUBJECT	THEORY/PAC	EVALUATION SCHEME		TOTAL MARKS
			IA	SE	
DAM-101	APPLIED MATHEMATICS-I	THEORY	50	50	100
DAP-102	APPLIED PHYSICS	THEORY	50	50	100
DAC-103	APPLIED CHEMISTRY	THEORY	50	50	100
DME-104	TECHNICAL DRAWING-I	THEORY	50	50	100
DME-105	WORKSHOP TECHNOLOGY-I	THEORY	50	50	100
DCS-106	COMMUNICATION SKILLS	THEORY	50	50	100
DHL-107	HINDI	THEORY	50	50	100
DME-108	WORKSHOP PRACTICE - I	PRAC	250	250	500
<b>TOTAL</b>			<b>600</b>	<b>600</b>	<b>1200</b>

### SECOND SEMESTER

SUBJECT CODE	SUBJECT	THEORY/PAC	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-204	TECHNICAL DRAWING-II	THEORY	50	50	100
DME-205	WORKSHOP TECHNOLOGY-II	THEORY	50	50	100
DME-206	MATERIAL SCIENCE	THEORY	50	50	100
DEE-207	BASICS OF COMPUTERS	THEORY	50	50	100
DME-208	WORKSHOP PRACTICE-II	PRAC	250	250	500
<b>TOTAL</b>			<b>600</b>	<b>600</b>	<b>1200</b>

### THIRD SEMESTER

SUBJECT CODE	SUBJECT	THEORY/PAC	EVALUATION SCHEME		TOTAL MARKS
			IA	SE	
DEE-301	ELECTRONIC DEVICES & CIRCUITS-I	THEORY	50	50	100
DME-302	ENGINEERING MECHANICS	THEORY	50	50	100
DME-303	ENGINEERING METEOROLOGY	THEORY	50	50	100
DME-304	CNC MACHINES	THEORY	50	50	100
DEE-305	DIGITAL ELECTRONICS	THEORY	50	50	100
DEE-306	ELECTRICAL MACHINES	THEORY	50	50	100

DEE-307	ANALOG ELECTRONICS LAB-I	PRAC	50	50	100
DEE-308	DIGITAL ELECTRONICS LAB-I	PRAC	50	50	100
DEE-309	ELECTRICAL LAB	PRAC	50	50	100
DEE-310	COMPUTER LAB-I	PRAC	50	50	100
<b>TOTAL</b>			<b>500</b>	<b>500</b>	<b>1000</b>

#### FOURTH SEMESTER

SUBJECT CODE	SUBJECT	THEORY/ PRAC	EVALUATION SCHEME		TOTAL MARKS
			IA	SE	
DEE-401	NETWORK, FILTERS & CIRCUIT THEORY	THEORY	50	50	100
DEE-402	COMPUTER PROGRAMMING AND APPLICATIONS	THEORY	50	50	100
DEE-403	COMMUNICATION SYSTEMS	THEORY	50	50	100
DME-404	CAD/CAM/CIM SYSTEMS	THEORY	50	50	100
DEE-405	ELECTRNIC DEVICES AND CIRCUITS-II	THEORY	50	50	100
DEE-406	MICROPROCESSOR AND ITS APPLICATIONS	THEORY	50	50	100
DEE-407	ANALOG ELECTRONICS LAB-II	PRAC	50	50	100
DEE-408	DIGITAL ELECTRONICS LAB -II	PRAC	50	50	100
DEE-409	COMPUTER LAB-II	PRAC	50	50	100
DEE-410	AUTOMATION STUDIO LAB	PRAC	50	50	100
<b>TOTAL</b>			<b>500</b>	<b>500</b>	<b>1000</b>

#### FIFTH SEMESTER

SUBJECT CODE	SUBJECT	THEORY/PRAC	EVALUATION SCHEME		TOTAL MARKS
			IA	SE	
DEE-501	INDUSTRIAL AUTOMATION	THEORY	50	50	100
DEE-502	PNEUMATIC AND HYDRAULIC SYSTEMS	THEORY	50	50	100
DEE-503	ELECTRICAL DRIVES	THEORY	50	50	100
DEE-504	LINEAR CONTROL SYSTEMS	THEORY	50	50	100
DEE-505	SIGNALS & SYSTEMS	THEORY	50	50	100
DEM-506	ENTREPRENEURSHIP DEVELOPMENT AND MANAGEMENT	THEORY	50	50	100
DEE-507	PNEUMATICS AND HYDAULICS LAB	PRAC	50	50	100
DEE-508	ELECTRICAL DRIVES LAB	PRAC	50	50	100
DEE-509	PLC PROGRAMMING LAB	PRAC	50	50	100

DEE-510	AUTOCAD ELEC. DESIGN LAB	PRAC	50	50	100
DEE-511	INDUSTRIAL TRAINING	-	-	-	100
DEE-512	MINOR PROJECT	-	-	-	100
<b>TOTAL</b>					<b>1200</b>

#### SIXTH SEMESTER

SUBJECT CODE	SUBJECT	THEORY/PAC	EVALUATION SCHEME		TOTAL MARKS
			IA	SE	
DEE-601	INNOVATION, DESIGN & MANUFACTURING	THEORY	50	50	100
DEE-602	INDUSTRIAL ENGINEERING & MANAGEMENT	THEORY	50	50	100
DEE-603	INDUSTRIAL ROBOTICS	THEORY	50	50	100
DEE-604	COMPUTER NETWORKS	THEORY	50	50	100
DEE-605	MICROCONTROLLER AND ITS APPLICATIONS	THEORY	50	50	100
DEE-606	MEASUREMENT AND INSTRUMENTATION	THEORY	50	50	100
DEE-607	MECHATRONICS LAB	PRAC	50	50	100
DEE-608	EMBEDDED SYSTEMS LAB- I	PRAC	50	50	100
DEE-609	ORCAD LAB	PRAC	50	50	100
DEE-610	ROBOTICS LAB-I	PRAC	50	50	100
DEE-611	STUDENT CENTERED ACTIVITIES	-	-	100	100
DEE-612	MAJOR PROJECT	-	-	100	100
<b>TOTAL</b>					<b>1200</b>

### ADVANCED DIPLOMA IN MECHATRONICS & INDUSTRIAL AUTOMATION

#### SEVENTH SEMESTER

SUBJECT CODE	SUBJECT	THEORY/PAC	EVALUATION SCHEME		TOTAL MARKS
			IA	SE	
DEE-701	PROCESS INSTRUMENTATION & SAFETY	THEORY	50	50	100
DEE-702	EMBEDDED SYSTEM DESIGN	THEORY	50	50	100
DEE-703	EMERGING TECHNOLOGIES –I	THEORY	50	50	100
DEE-704	INDUSTRIAL ROBOTICS LAB-II	PRAC	50	50	100
DEE-705	EMBEDDED SYSTEMS LAB- II	PRAC	50	50	100
DEE-706	PROCESS INSTRUMENTATION & SAFETY LAB	PRAC	50	50	100
DEE-707	INDUSTRIAL PROJECT	PRAC	-	-	100

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DEE-708	INDUSTRIAL TRAINING	PRAC	-	-	100
DEE-709	PROFESSIONAL PRACTICE-I	PRAC	-	-	200
<b>TOTAL</b>					<b>1000</b>

#### EIGHTH SEMESTER

SUBJECT CODE	SUBJECT	THEORY/ PRAC	EVALUATION SCHEME		TOTAL MARKS
			IA	SE	
DEE-801	INSTRUMENTATION APPLICATIONS / POWER ELECTRONICS	THEORY	50	50	100
DEE-802	INDUSTRIAL ROBOTICS-II	THEORY	50	50	100
DEE-803	ADVANCED PROCESS CONTROL	THEORY	50	50	100
DEE-804	PROFESSIONAL PRACTICE-II	PRAC	-	-	200
DEE-805	INDUSTRIAL PROJECT	PRAC	-	-	500
<b>TOTAL</b>					<b>1000</b>

## FIRST SEMESTER

### **DAM- 101 ENGINEERING MATHEMATICS - I**

#### **1. Algebra**

(a) Complex Numbers, representation, modulus and amplitude. De-Moivre's theorem, its application in solving algebraic equation, (b) Basics and properties of logarithms and its applications in solving problems related to basic logarithmic formulas, (c) 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, (d) Partial fractions (linear factors, repeated linear factors, non-reducible quadratic factors excluding repeated factors), (e) Permutations and Combinations: Value of  $nPr$   $nCr$ . Simple problems of formulation of words from given alphabets (with and without repetition), circular permutations etc, and (f) 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.

#### **2. Trigonometry**

(a) 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, (b) 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 ( $2A$ ,  $3A$ ,  $A/2$ ), (c) Graphs of  $\sin x$ ,  $\cos x$ ,  $\tan x$  and  $e^x$ , (d) Applications of Trigonometric terms in engineering problems such as to find an angle of elevation, height, distance etc.

#### **3. Co-ordinate Geometry**

(a) Cartesian and Polar coordinates (two dimensional), conversion from Cartesian to polar coordinates and vice-versa, distance between two points (Cartesian coordinates), section formulae, (b) 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, (c) 3.3 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, (d) 3.4 General equations 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, (e) Equations 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**

**1. 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.

**2. 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.

**3. 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

**4. 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.

**5. 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.

**6. 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.

**7. 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]. RECOMMENDED BOOKS of Physics for Class XI (Part-I, Part-II) N.C.E.R.T
- [2]. RECOMMENDED BOOKS 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 Shetal Kumar, Cengage Learning India Pvt. Ltd. Patparganj, Delhi (year 2008)

## DAC- 103 APPLIED CHEMISTRY

**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.

**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.

**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.

**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**

### **1. Drawing Office Practice**

Drawing instruments, Sizes and layout of standard drawing sheets, Sizes of drawing boards, Drafting table/board.

### **2. Different types of Lines and Free Hand Sketching**

Different types of lines in engineering drawing as per BIS specifications, Practice in free hand sketching of vertical, horizontal and inclined lines, geometrical figures such as triangles, rectangles, small and large circles, parabolas, curves and ellipses.

### **3. Technical writing of letters and numerals in different sizes.**

### **4. 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.

### **5. Scale**

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

### **6. 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.

### **7. 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.

## **DME-105 WORKSHOP TECHNOLOGY-I**

### **1. Hand Tools and Measuring Tools**

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

1.2 Various types and uses of vernier caliper, micrometer, height gauge, depth gauge dial gauge, bevel protector, centre square, pug gauges, snap gauges, slip gauges, comparator, taper & thread ring/plug gauges and their maintenance.

### **2. Cutting Tools and Cutting Materials**

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

### **3. Introduction to Lathe Machine**

- 3.1 Introduction and working principle of Lathe machine
- 3.2 Description and function of various parts of a lathe machine
- 3.3 Classification and specification of various types of lathe machine
- 3.4 Drives and transmission used in lathe machine
- 3.5 Work and tool holding devices for lathe machine
- 3.6 Various cutting tools of Lathe: Parameters/Nomenclature & applications
- 3.7 Various Lathe machine operations :- Plain and step turning, facing, parting off, taper turning, eccentric turning, drilling, reaming, boring, threading and knurling, form turning, spinning.
- 3.8 Cutting parameters – Speed, feed and depth of cut for various materials and for various operations, machining time.
- 3.9 Speed ratio, preferred numbers of speed selection.
- 3.10 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.
- 3.11 Brief description of capstan and turret lathe machine, comparison of capstan/Turret lathe, work holding and tool guiding devices in capstan and turret lathe.

### **4. Drilling & Reaming**

- 4.1 Introduction and working principle of drilling.
- 4.2 Classification of drilling machines and their description.
- 4.3 Various operations performed on drilling machine – drilling, spot facing, reaming, boring, counter boring, counter sinking, hole milling, tapping.
- 4.4 Speeds and feeds during drilling, impact of these parameters on drilling, machining time.
- 4.5 Types of drills and their features, nomenclature of a drill
- 4.6 Drill holding devices.
- 4.7 Types of reamers.

### **5. Boring**

- 5.1 Introduction and working principle of boring
- 5.2 Classification of boring machines and their brief description.
- 5.3 Specification of boring machines.
- 5.4 Boring tools, boring bars and boring heads.
- 5.5 Description of jig boring machine.

### **6. Shaping, Planing and Slotting**

- 6.1 Introduction and working principle of shaper, planer and slotter machines.
- 6.2 Type of shapers
- 6.3 Type of planers
- 6.4 Quick return mechanism applied to shaper, slotter and planer machine.
- 6.5 Work holding devices used on shaper, planer and slotter.
- 6.6 Types of tools used and their geometry.
- 6.7 Specification of shaper, planer and slotting machine.
- 6.8 Cutting parameters used in Shaping, Planing and Slotting processes.

### **7. Casting Processes**

- 7.1 Introduction and working principle casting process
- 7.2 Pattern Making : Types of pattern, Pattern material, Pattern allowances, Pattern codes as per B.I.S., Introduction to cores, core boxes and core materials, Core making procedure, Core prints, positioning of cores.
- 7.3 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.
- 7.4 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.
- 7.5 Melting and Pouring of Metal: Charging a furnace, melting and pouring both ferrous and non ferrous metals, pouring equipments, cleaning of castings,
- 7.6 Special Casting Processes: Principle, working and applications of Die casting: hot chamber and cold chamber, Investment casting, Centrifugal casting.
- 7.6 Gating and Riser System: Introduction, Elements of gating system: Pouring basin, sprue, runner, gates, risers, Directional solidification.
- 7.7 Melting Furnaces: Construction and working of Pit furnace, Cupola furnace, Crucible furnace, Electric furnace.
- 7.8 Casting Defects: Different types of casting defects, Inspection and Testing of defects: visual, liquid penetrant, radiography, magnetic particle inspection and ultrasonic inspection.

#### **LIST OF 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. 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. Manufacturing Science and Technology by A Manna, Prentice Hall of India, Delhi.

#### **DCS-106 COMMUNICATION SKILLS (ENGLISH)**

1. Intensive remedial course in English grammar, prepositions, correction, punctuation, Vocabulary, words, phrases, antonyms.
2. Paragraph writing: technology, science, economics, political, social, general.
3. English Speaking; GD's, About One-Self. Listening: Pearson and Longman series. Reading on various authors.
4. A course in written English, 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.
5. Communication techniques: one & two way communications, essential of good communications, methods of effective oral, written & non-verbal communication.
6. Intensive remedial course in English grammar, voice, narration, tenses. Vocabulary, idioms, phrases, synonyms.

#### **LIST OF RECOMMENDED BOOKS**

1. Spoken English (English Improvement for Success) by Alison Reid
2. Usage And Abusage: A Guide To Good English by Eric Partridge
3. Eats, Shoots & Leaves: The Zero Tolerance Approach to Punctuation by Llynne Truss

#### **DHL-107 COMMUNICATION SKILLS (HINDI)**

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2. rduhdh vuokn] rduhdh 'kcnkoyh] I ekun'kiz 'kcn] I ekukfkz] i rhr gkus okys 'kcn] vuclfkz] 'kcn & vfkz , oaokD; iz kx] 0; fDrxr] 0; kol kf; d] I jdkjh] v/k] jdkjh] futh lk= y[ku] fu/kk'jr dgkuh I xgA
3. fojhrkfkz] okD; kak dsfy, , d 'kcn] fjikrkt y[ku] rduhdh vuokn] rduhdh 'kcnkoyh] fucdk , oay[k I xg] i kB dk foopu] dfBu 'kcnk ds vfkz , oa iz kx A
4. ykclkrDr , oa egkojs v/vfkz , oa iz kx] i k: i .k] fVli .kh , oafucdk y[ku] rduhdh , oa0; kol kf; d fo'k; ka ij fopkj vfhk0; fDr] rduhdh vuokn] rduhdh 'kcnkoyh A

## DME-108 WORKSHOP PRACTICE-I

### FIRST & SECOND SEMESTER:

Skill based training on workbench, use of hand tools and measuring instruments. Introduction to drilling, tapping, turning, shaping, welding, soldering, brazing and re-sharpening of tools. Training in precision machine tool operations: lead screw lathe, universal milling machine, surface grinder. Advanced bench work for making different assemblies. Manufacture of scientific equipment & instrument parts and prototypes. Introduction to Programming, Simulation and working on CNC Milling and CNC lathe.

## SECOND SEMESTER

### DAM-201 APPLIED MATHEMATICS – I

#### 1. Algebra

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

#### 2. Differential Calculus

- 2.1 Definition of function; Concept of limits.

$$\lim_{x \rightarrow a} x^n - a^n,$$

Four standard limits  $x \rightarrow a$  -----

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

- 2.2 Differentiation of  $x^n$ ,  $\sin x$ ,  $\cos x$ ,  $\tan x$ ,  $e^x$ ,  $\log_a x$

- 2.3 Differentiation of sum, product & quotient of functions and function of a function.

- 2.4 Differentiation of trigonometric inverse functions. Logarithmic, Exponential and Successive differentiation.

- 2.5. 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

#### 3. Integral Calculus

- 3.1 Integration as inverse operation of differentiation with simple examples.

- 3.2 Simple integration by substitution, by parts and by partial fractions

- 3.3 Evaluation of definite integrals by explaining the general properties of definite integrals.

- 3.4 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

#### **4. Statistics and Probability**

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

#### **5. Differential Equations**

- 5.1 Solution of first order and first degree differential equation by variable separation method
- 5.2. Differential equations of homogeneous equation

#### **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**

### **1. Fundamentals of Electricity**

Modern electron theory, molecules, charges, different sources of electrical energy, various applications of electricity, advantages of electrical energy over other energy. Definition of potential difference, voltage, current, power, energy. Effects of electric current, electrical symbols, units, abbreviations, concept and difference between AC & DC. Electromagnetism: Electromagnetic induction, Faraday's Laws, Fleming, Rules, self induction, mutual induction. Single Phase and 3 Phase Supply: 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.

### **2. DC Circuits & AC Circuits**

Ohm's Law, series, parallel and series-parallel circuits Kirchhoff's Laws. 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.

### **3. DC Machines**

Basic working principle of DC machine as a generator and a motor; Types (DC Series Motor, DC Shunt Motor, DC Compound Motor, constructional features; commutator, EMF equation of DC generator, back EMF and its significance.

**4. Safety & Earthing:** Concept of earthing, necessity of earthing, methods of earthing, difference between grounding & earthing, leakage current, earthing resistance, MCB, ELCB.

**5. AC Machines:** Alternator: Working Principle and construction details, Transformer: 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, Induction Motors Working principle of AC motor, concept of rotating magnetic field; principle of operation, constructional features; slip, applications of squirrel cage motors.

#### **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

**1. 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.

**2. 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.

**3. 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.

## RECOMMENDED BOOKS

[1] Electronics devices and circuits by Millman & Halkias

## DME-204- TECHNICAL DRAWING-II

**1. 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.

**2. Threads:** Nomenclature of threads, types of 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.

**3. 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.

**4. Tolerances and fits :** Tolerances and fits, viz. Basic hole/shaft system, standard deviations and IT grades system, tolerated characteristics on machine parts viz. Straightness, flatness, cylindricity etc. Surfaces finish and welding symbols. SP-46 symbol standards of BIS.

**5. Construction of regular polygon:** Construction of regular polygon Curves used in engineering drawing viz. Ellipse, parabola, hyperbola, involute, cycloid, helix and spiral. Standard components viz. Bolts, screws, nuts, washers, rivets, keys, springs, bearings, standard tapers, spur & bevel gears. Universal joints, Couplings, machine components.

**6. Development of sheet metal parts:** Development of sheet metal parts viz. Cones, pyramids, cylinders, intersection & penetration. Preparation of assembly drawings from details and vice-versa. Drawings of Jigs and fixtures, Design and drawing of Cams. Details and assembly drawings of various devices, jigs and small precision components with emphasis on fits, tolerance and surface finish symbols.

### **RECOMMENDED BOOKS**

1. Technical Drawing with Engineering Graphics-by Frederick Giesecke
2. Basic Technical Drawing-by Henry Spencer

## **DME 205- WORKSHOP TECHNOLOGY-II**

### **1. Milling**

- 1.1 Introduction and working principle of milling machine
- 1.2 Nomenclature and types of milling cutters and work mandrels
- 1.3 Classification, brief description and applications of milling machines
- 1.4 Details of column and knee type milling machine
- 1.5 Milling machine accessories and attachment- Arbors, adaptors, collets, vices, circular table, indexing head and tail stock, vertical milling attachment
- 1.6 Milling methods - up milling and down milling
- 1.7 Work holding devices
- 1.8 Milling operations – face milling, angular milling, form milling, straddle milling and gang milling.
- 1.9 Cutting speed and feed, simple numerical problems.
- 1.10 Indexing on dividing heads, plain and universal dividing heads.
- 1.11 Indexing methods: direct, Plain or simple, compound, differential and angular indexing, numerical problems on indexing.
- 1.12 Thread milling

### **2. Grinding**

- 2.1 Purpose of grinding
- 2.2 Various elements of grinding wheel – Abrasive, Grade, structure, Bond
- 2.3 Common wheel shapes and types of wheel – built up wheels, mounted wheels and diamond wheels. Specification of grinding wheels as per BIS.
- 2.4 Truing, dressing, balancing and mounting of wheel.
- 2.5 Grinding methods – Surface grinding, cylindrical grinding and centreless grinding.
- 2.6 Grinding machine – Cylindrical grinder, surface grinder, internal grinder, centreless grinder, tool and cutter grinder.
- 2.7 Selection of grinding wheel
- 2.8 Thread grinding.

### **3. Broaching**

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

### **4. Metal Forming Processes**

- 4.1 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

- 4.2 Forging - Open die forging, closed die forging, Press forging, upset forging, swaging, up setters, roll forging, Cold and hot forging
- 4.3 Rolling - Elementary theory of rolling, Types of rolling mills, Thread rolling, roll passes, Rolling defects and remedies
- 4.4 Extrusion and Drawing - Type of extrusion- Hot and Cold, Direct and indirect. Pipe drawing, tube drawing, wire drawing

## 5. Welding

### 5.1 Welding Process

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

### 5.2 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

### 5.3 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

### 5.4 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.

### 5.5 Modern Welding Methods

Methods, Principle of operation, advantages, disadvantages and applications of, 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

## 6. Cutting Fluids and Lubricants

- 6.1 Function of cutting fluid
- 6.2 Types of cutting fluids
- 6.3 Difference between cutting fluid and lubricant
- 6.4 Selection of cutting fluids for different materials and operations
- 6.5 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]. Production Engineering by PC Sharma; S Chand and Company Ltd. Delhi

## DME 206- MATERIAL SCIENCE

**1. Importance of Materials :** Classification: Metals and non-metals, Ferrous and non-ferrous metals and their alloys Names of common metals, their alloys and non-metals used in Industry. Properties of metals and alloys: Physical properties - Appearance, luster, colour, density and melting point, Mechanical Properties: Strength, stiffness, elasticity, plasticity, toughness, ductility, malleability, brittleness, hardness, fatigue and creep, Thermal and electrical conductivity Corrosion, causes, effects and prevention.



**2. Metallurgical Considerations :** Solidification of metals from liquid to solid state of pure metals, cooling curves of pure metals, dendritic solidification, crystal formation, types of crystal structure. Phase diagrams, Effects of all alloying elements on engineering materials. Effect of grain size on mechanical properties.

### **3. Ferrous Metals and Alloys**

Flow diagram for the production of ferrous metals from their ores, constituents of iron, iron carbon diagram. Classification, composition and uses of cast iron and plain carbon steels. IS, BS and SAE Grades Effect of alloying elements such as Aluminium, chromium, Nickel, Cobalt, Manganese, Molybdenum, tungsten, Vanadium, Silicon, Sulphur and Phosphorous on steels. Composition, properties, grades and uses of special steels such as High speed steel, Stainless steels, Silicon steels, Heat resistant steels, Spring steel.

### **4. Introduction to Heat Treatment**

Iron-carbon diagram, objectives and practical aspects of heat treatment. Brief description and uses with examples of principal heat treatment processes, Annealing, Normalizing, Tempering, Hardening, Carburising, Nitriding and Cyaniding and applications. Examples in heat-treating engineering components time, temperature transformation curve.

### **5. Non-ferrous Metals and Alloys Copper: Properties and uses**

Composition, properties and uses of copper alloys, Brasses: Cartridge brass, Nickel silver. Bronzes: Phosphor bronze, Al-bronze, Mn-bronze, and Gun metal. Properties and uses of Aluminium. Composition, properties and uses of Al-alloys e.g., Duralumin, Yellow metal, Magnalium and Hindalium Properties and uses of alloys of lead, tin and magnesium. Bearing Metals: Requisite qualities. Composition, properties and uses of white metal bearing, copper based bearing metals. Aluminium based bearing metals. Use of nylon/PTFE for bushes/bearings, bimetallic and tri-metallic bushes.

### **6. Identification and Examination of Metals and Alloys**

Identification tests - Appearance, sound, filing, weight, magnetic, spark, bend and microstructure. Different types of etchants for preparation of surface structure.

### **7. Other Important Materials**

Plastics: Definition, classification of plastics, fibre glass, reinforced plastics. Major applications of various plastics and their uses and grades, Composite materials. Heat insulating materials: Properties and uses of asbestos, glass wool, thermocouple, cork, mica.

Electrical insulating materials, Properties and uses of china clay, leather, bakelite, ebonite, glass wool, rubber, felt. Sound insulating materials: Cork, fibre boards. Fabrication materials: Wood, plywood, rubber – natural and synthetic, Glass – plate glass, toughened glass, safety glass. Refractory materials: General characteristics and uses of dolomite, ceramics. Protective coating materials: Paints, primers, varnishes, enamels, putti, electroplating materials, rubasil, teflon coating. Sealant and adhesives – Application and availability of sealant and adhesives for industrial user.

### **8. Selection, specifications and commercial availability of materials**

Practical considerations for selection of material for different purposes ISO/BIS specifications for metals, non-metals, various components and materials.

### **RECOMMENDED BOOKS**

1. Materials Science and Engineering-by William Callister
2. MATERIALS SCIENCE AND ENGINEERING: A FIRST COURSE-by V. Raghavan
3. CALLISTER'S MATERIALS SCIENCE AND ENGINEERING -by R. Balasubramaniam

- 1. 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.
- 2. 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.
- 3. 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.
- 4. Basic of Computer Networking:** basic hubs, switches, routing, networking protocols (LAN, MAN, WAN) and their topologies.
- 5. 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

### **DME208- WORKSHOP PRACTICE-II**

Skill based training on workbench, use of hand tools and measuring instruments. Introduction to drilling, tapping, turning, shaping, welding, soldering, brazing and re-sharpening of tools. Training in precision machine tool operations: lead screw lathe, universal milling machine, surface grinder. Advanced bench work for making different assemblies. Manufacture of scientific equipment & instrument parts and prototypes. Introduction to Programming, Simulation and working on CNC Milling and CNC lathe.

### **THIRD SEMESTER**

#### **DEE-301 ELECTRONIC DEVICES AND CIRCUITS –I**

- 1. Introduction to 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.
- 2. Transistor Characteristics & Stabilization of BJT:** Bipolar Junction Transistor (BJT)– Construction, Operation, Amplifying Action , Common Base ,Common Emitter and Common Collector Configurations, Operating Point, Voltage Divider Bias Configuration. Transistor biasing circuits, cut off and saturation region design problems, AC load line, current and voltage gain, transistor hybrid low frequency model, ‘h’ parameters and their physical significance.
- 3. Transistor Amplifiers :** Classification, Small Signal Amplifiers –Basic Features, Common Emitter Amplifier, Coupling and Bypass Capacitors, Distortion, AC equivalent Circuit; Feedback Amplifiers– Principle, Advantages of Negative Feedback, Topologies, Current Series and Voltage Series Feedback Amplifiers.
- 4. Field Effect Transistor (FET) :** Construction, operation, characteristics and equivalent circuit of JFET, MOSFET and its applications.
- 5. Power Supply:** Different types of Power Supply, Regulated DC Power Supply and Unregulated Power Supply

## RECOMMENDED BOOKS:

[1] EDC by Miliman Halkias

### DME-302 ENGINEERING MECHANICS

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

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

**3. 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.

**4. Friction:** Definition and concept of friction, types of friction, force of friction. Laws of static friction, coefficient of friction, angle of friction, angle of repose, cone of friction. Equilibrium of a body lying on a horizontal plane, equilibrium of a body lying on a rough inclined plane. 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.

**5. Centre of Gravity:** Concept, definition of centroid of plain figures and centre of gravity of symmetrical solid bodies, Determination of centroid of plain and composite lamina using moment method only, centroid of bodies with removed portion, Determination of center of gravity of solid bodies - cone, cylinder, hemisphere and sphere; composite bodies and bodies with portion removed.

**6. 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 (1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup> 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.

### DME303- ENGINEERING METEROLOGY

**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.

**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

**1. 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.

**2. Basic components and Classification of NC Systems:** Basic components of a NC system, Programme of Instructions, NC Coding, Machine control unit, Machine Tool, The NC procedure. Classification of CNC machines based on control system and on motion control system, Coordinate system, axis Identification, several zero's of CNC machine.

**3. Constructional details and Tooling of CNC machines :** 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.

**4. 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.

**5. 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 Puble-books ications, New Delhi.

### DEE 305- DIGITAL ELECTRONICS

**1. Introduction to Number System :**Binary and hexadecimal number system, conversion from decimal and hexadecimal to binary and vice versa, Binary addition, subtraction, multiplication and division including binary points.1's and 2's complement method of addition/subtraction.

**2 Logic Gates :**Concept of negative and positive logic, Definition, symbols and truth tables of NOT, AND, OR, NAND, EXOR Gates, NAND and NOR as universal gates, Boolean algebra, DE Morgan's Theorems, truth table and Boolean equation, Solving Boolean expressions using K Maps.

**3. Combinational Circuit Design:** Half adder and Full adder & Subtractor circuit, design and implementation, Code convertors, Encoders, Decoders, MUX and DEMUX etc.

**4. Sequential Circuit Design:** Latches and Flip Flops, Operation using waveforms and truth tables of RS, T, D, JK, Master/ Slave JK flip flops ,Counters Shift Register, Binary counters, Down counter, up down counter ,Asynchronous and Synchronous counters, Universal shift register, Buffer register.

**5. Logic Families:** Logic Family Classification, TTL and MOS families, Characteristics of TTL and MOS digital gates, fanon , fan-out.

### RECOMMENDED BOOKS

[1] Digital electronics by Morris Mano.

### DEE 306- ELECTRICAL MACHINES

**1. Alternators (AC generator):** Principle of working of alternators, their constructional details, salient pole type and non-salient pole type of alternators, E.M.F Equation, parallel operation of alternators.

**2. Transformer:** Principle of operation and constructional details of single phase and three-phase transformer, core type and shell type transformers, difference between single phase and three phase transformers, advantages and disadvantages, Voltage Regulation of a transformer (No Derivation),

Losses in a transformer, Efficiency, condition for maximum efficiency and all day efficiency, Auto transformers and instrument transformer, CTs and PTs (Current transformer and potential transformer).

**3. Three Phase Distribution System :** Advantage of three-phase system over single-phase system, Direct On Line Starter, Star Delta connections, Relation between phase and line voltage and current in a three phase system, Power and power factor in three-phase system and their measurements by one, two and three Wattmeter methods.

**4. Induction Motor :** Revolving magnetic field produced by poly phase supply, brief introduction about three phase induction motors, its principle of operation , Types of induction motors and constructional features of squirrel cage and slip-ring motors, Starting and speed control, Star Delta and DOL (Direct-on-line) starters, Reversal of direction of rotation of 3-phase induction motors, Applications of induction motors. Single Phase Fractional Kilowatt Motors: Introduction, Principle of operation of single phase motors, Types of single phase induction motors and their constructional details (i.e. split phase, capacitor start, capacitor start and run, shaded pole and reluctance start), Single phase synchronous motors – reluctance motor (hysteresis motor), Commutator type single-phase motors – Repulsion Induction motor, shaded pole motors, AC series motor and universal motors, Introduction to servo- motors and stepper motors.

**5. Synchronous Motor:** Operating Principle of synchronous motor, constructional features, Making Synchronous Motor Self-Starting, Motor on Load, Effect of Changing Field Excitation at Constant Load, Power Factor of Synchronous Motors, Synchronous Condenser, Applications of Synchronous Motors, Comparison of Synchronous and Induction Motors.

**6. Electrical Protective Devices & Back-up systems:** 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. Back-up Systems: Concept of Cell and battery, Ah capacity, concept of online & offline UPS, selection of Inverter/UPS.

### **RECOMMENDED BOOKS**

- [1] Electrical Machine by SK Bhattacharya, Tata McGraw Hills, New Delhi
- [2] Electrical Machines by Nagrath and Kothari, Tata McGraw Hills, New Delhi
- [3] Electrical Machines by SK Sahdev, Unique International Publications, Jalandhar
- [4] Electrical Engineering by JB Gupta, SK Kataria & Sons, New Delhi
- [5] Electrical Technology Vol. - I and II B.L. Thareja, S Chand and Co. New Delhi

### **DEE-307 ANALOG ELECTRONICS LAB-I**

Familiarization, Testing and use of various electronics components such as resistor capacitor inductor diode transistor and ICs , Hands on use of various electronics instruments such as DMM, DSO, Function Generator , DC regulated Power Supply etc, Study analysis and measurement of various analog circuit and various signals, Design of HWR,FWR, Bridge FWR and measurement of ripple factor etc. Capacitor based circuit. Characterization of diode, zener diode, PTCR,NTCR, incandescent lamp etc.

### **DEE-308 DIGITAL ELECTRONICS LAB-I**

Hands on use of various electronics instruments like multimeter, power supply, function generator, digital storage oscilloscope. Study about integrated circuits. Study of various components like logic gates, 555 timer, multivibrators and combinational logic circuits.

### **DEE-309 ELECTRICAL LAB**

To connect a switch and a lamp in electric supply, To connect two switches in series & parallel lamps in electric supply, connecting a switch and a socket in electric supply, To make the Connection of Stair case wiring with 2 way switches, To connect a switch and a fan & regulator in electric supply, To make the wiring , connection & testing of a florescent lamp fitting, To make the Connection & testing of extension board, To calculate power, current, capacity of main circuit breaker of a electrical installation, To verify Ohm's Law, To make the Connection and testing of a single phase motor, To calculate transformation ratio of a single phase transformer, To calculate and measure power, current, impedance and power factor of RLC series circuit, To study and analysis the performance characteristics of DC Series motor, DC Shunt Motor, To control and run of a 3 Phase induction motor with DOL starter, To control and run of a 3 Phase induction motor with Star/Delta connections.

### **DEE-310 COMPUTER LAB-I**

Identification and study of different parts of computer and their interconnections, Technical specifications of I/O components & computer hardware, to assemble a PC, Configuration of motherboard CMOS/RAM etc, Configuration, Partitioning & formatting of HDD, Installation of OS & other software, installation of antivirus software and removal of viruses, Drivers installation of peripherals devices, Interfacing of different peripherals with computers system, Installation of hubs / switches / routers used in LAN connection, Introduction to TCP/IP communication protocols, configuration of internet & intranet, Sharing of resources between computer networks, study different types of printers, Fault detection & repair of basic I/O components such as keyboard, mouse etc, Different types of error detection and troubleshooting encountered during printing, Troubleshooting, maintenance & repair of computer system, Introduction and basics of some important commands of command prompt.

## **FOURTH SEMESTER**

### **DEE-401 NETWORK, FILTERS & CIRCUIT THEORY**

**1. Networks:** Symmetrical and asymmetrical networks; Balanced and unbalanced network; T-network, pie network, ladder network; Lattice network; Symmetrical Network, propagation constant, attenuation constant, phase shift constant and insertion loss. Asymmetrical Network.

**2. Attenuators:** Units of attenuation (decibels and Napers), General characteristics of attenuators. Analysis and design of simple attenuator of following types; Symmetrical T and pie type, L type 28.

**3. Filters:** Filter networks in different communication system, low pass, high pass, band pass and band stop filters. Reactance vs. frequency characteristics, Attenuation Vs frequency; Phase shift Vs frequency, characteristics impedance vs. frequency of T, M-derived Filter sections Limitations of prototype filters, Active Filters and passive filters.

**4. Circuit Theory:** Kirchhoff's laws, Capacitance, energy stored in a capacitor – capacitance of parallel plate capacitor – capacitors in series and in parallel. Thevenin Theorem, Norton Theorem, Superposition Theorem, Max Power Transfer Theorem. Series and Parallel Resonance Circuits and Network Parameters & their Relationship.

### **RECOMMENDED BOOKS**

[1] Network theory by A. Chakrabarti

## DEE-402 COMPUTER PROGRAMMING AND APPLICATIONS

- 1. Algorithm and Program Development:** Steps in development of a program, Flow-charts, algorithm development, Introduction to various computer languages, Concept of interpreter, compiler, high level language, machine language and Assembly Language.
- 2. Basic C Programming :** History of 'C', data types, input output statements, arithmetic and logical operations, data assignments, precedence and associativity, I/O statements, Assignment, Variables, arithmetic operation- their precedence, data types standard I/O, function, formulated I/O, Control Statements, Logical and relational operators; if-else, while, do- while, for loops, breaks, switch, statements, Functions: Function declaration, parameter passing- by value, storage classes (Local, Global and Static variables), standard library functions ,Arrays: Single and multi dimensional arrays, character arrays,
- 3. Advanced Functions:** Pointers: To various data types, pointers in parameters passing, pointers to function, Structures: Definition of a structure, pointer to structure, union and array of structure, Strings: String processing, functions and standard library function, Data files, File handling and manipulation, file reading and writing, Binary and ASCII files, file records using standard function type mouse.

### RECOMMENDED BOOKS

[1] C Programming by Balagurusamy

### DEE 403: COMMUNICATION SYSTEMS

- 1. Introduction:** Communication systems, signals and spectra, communication channels and propagation characteristics.
- 2. Analog Modulation Techniques:** Theory of Amplitude Modulation, AM Power, Calculations, Theory of Frequency Modulation (FM); Theory of Phase Modulation, Comparison of AM and FM, comparison of PM and FM, Pre-emphasis and De-emphasis.
- 3. AM Transmitter & Receiver:** Generation of Amplitude Modulation, Basic Principles of AM Generation; Square law Diode Modulation, Suppressed Carrier AM generation, Ring Modulator, Balanced Modulator. Tuned Radio Frequency (TRF) Receiver, Basic Elements of AM Super heterodyne receiver.
- 4. FM Transmitter & Receiver :** Generation of FM by Direct Methods, Indirect Generation of FM, FM Receiver, Direct Methods of Frequency Demodulation,
- 5. Digital Communication Techniques:** Sampling theorem, Signal reconstruction in time domain, Pulse amplitude modulation, Pulse width modulation, Pulse position modulation, Pulse Code Modulation, Types of digital modulation Frequency and phase Shift Keying, Method of generation and detection of coherent & noncoherent binary ASK, FSK & PSK.

### RECOMMENDED BOOKS

[1] George Kennedy, "Electronic Communication System", McGraw- Hill.

[2] Lathi B P, "Digital and Analog Communication Systems", Oxford University Press

### DME-404 CAD/CAM/CIM SYSTEMS

- 1. 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.



**2. 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.

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

**4. Introduction to 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.

**5. Fundamentals of Industrial Robotics:** 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.

**6. Essential CAD/CAM tools for CIM Systems:** Lean manufacturing, GT, CAPP, CAQC, MPS, 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.

## **DEE405- ELECTRONIC DEVICES AND CIRCUITS- II**

**1. Oscillators:** Classification and Working Operation and Applications of Sine Wave and Non- Sine Wave Oscillators, IC 555 Timer - Block Diagram, Astable, Monostable and Bi-Stable Multivibrator.

**2. Operational Amplifiers and Applications :**Introduction to Op-Amp, Differential Amplifier Configurations, Block Diagram, Pin Configuration of 741 Op-Amp, Characteristics of Ideal OpAmp, Concept of Virtual Ground, Inverting, Non-Inverting, Summing and Difference Amplifiers, Voltage Follower, Comparator, Differentiator, Integrator and special purpose amplifier including Instrumentation Amplifier, Isolation Amplifier, Transconductance Amplifier etc.

**3. Power Electronics Devices:** Introduction of Power electronic devices, Construction, Characteristic, working operation and application of SCR, Diac, Triac and UJT.

### **RECOMMENDED BOOKS**

[1] Operational Amplifiers and Linear IC by Ramakant K Gaikwad by Oxford Publishers

[2] Power Electronics by P.S Bimbhra by Khanna Publishers

## **DEE406- MICROPROCESSOR AND ITS APPLICATIONS**

**1. Introduction to Microprocessors :**Basics of Microprocessors, Memory Accessing, Address bus, data bus and control bus, register section, arithmetic and logic unit, interrupt control, timing and control unit.

**2. 8085 Architecture:** Introduction, basic features of 8085, special features of 8085, 8085 CPU architecture. Register section, arithmetic and logic section, instruction decoder and machine cycle encoder, address buffer, interrupt control, serial I/O control group, timing and control, 8085 pin diagram, demultiplexing address and data bus.

**3. Introduction to Programming:** Instruction formats, timing diagrams, instruction cycle, machine cycle and T states, 8085 machine cycles, addressing modes, classification of instruction set, data transfer group, arithmetic group, logical group, stack control and branching group. Programming examples. Methods of introducing software delays, programming examples.

**4. Interrupt system of 8085 :** Polling and interrupts, basic definitions of interrupts, 8085 interrupt structure, TRAP, RST 7.5, RST 6.5 and RST 5.5, INTR, microprocessors response to RST instruction, interrupt acknowledge machine cycle, microprocessor response to CALL instruction, Interrupt vector locations, software interrupts of 8085.

**5. Microprocessor Applications:** Any two Case Studies

#### **RECOMMENDED BOOKS**

[1] Goankar, Ramesh. "Microprocessor Architecture. Programming and Applications with the 8085", Fifth Edition, Penram International Publishing (India), Mumbai, 2002

[2] Microprocessors and Its Applications by U S Shah Tech-Max Publications

### **DEE 407- ANALOG ELECTRONICS LAB-II**

Study analysis, Designing and measurement of various analog circuit such as amplifier, astable multivibrator, oscillator using BJT and FET transistor, filters , Dimmer Circuit using power electronic devices SCR, DIAC, TRIAC. Designing of various op-amp based circuits such as inverting ,non- inverting amplifier, comparator ,summing amplifier, difference amplifier etc.

### **DEE-408 DIGITAL ELECTRONICS LAB-II**

Study of various components and circuits like flip flops, shift registers, counters, 7 – segment display, Multivibrators using digital ICs

### **DEE-409 COMPUTER LAB-II**

Basic C programs, Basic structure and syntax of a C programming, Practice of basic data types and their format, Variables & operands used in C language, Executing of basic Input and Output commands used in C programs, Conditional statements used in C (if, if-else and switch), Problems involving loop statements, One-dimensional Arrays, Use of Strings, Two-Dimensional Arrays, Practice problems related to One and two-dimensional arrays, Basic of C++, Practice problem related to one & two dimensional array

### **DEE-410 AUTOMATION STUDIO LAB**

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.

## **FIFTH SEMESTER**

### **DEE- 501 INDUSTRIAL AUTOMATION**

**1. Introduction To Industrial Automation:** Role of automation in industries - Types of production systems and automation systems - architecture of industrial automation systems, Introduction to production systems - Material transport systems (conveyors and cranes).

**2. Control of Industrial Process :** DDC: Direct digital control, features of DDC, Hierarchy of distributed control system, features of DCS system, Distributed Control System (DCS), Supervisory

control and data acquisition systems, purpose of SCADA, Types of industrial processes, SCADA suitability, SCADA Vs. DCS, variables and objects in controlled plants, controlled variables, uncontrolled variables, remotely controlled objects, locally controlled objects, layout of SCADA system, components of SCADA and modified SCADA system, SCADA software packages, Application example of SCADA Networking Technologies deployed in SCADA systems.( Profibus and Profinet). Introduction to Programmable automation controllers (PACS), PACs

**3. Introduction to LANs:** Automatic data capturing (bar codes, RFID, magnetic stripes, optical character recognition).

**4. Process Safety Management System:** Introduction to process safety, risk, risk terminologies, consequence and risk, risk measurement, Process Hazard Analysis (PHA), Hazard and operability study (HaZOp), Safety Integrity Level (SIL), Introduction to IEC61511 standard for Functional safety , protection layers, Safety Instrumented System: function, architecture, safety life cycle, Application of safety system.

#### **RECOMMENDED BOOKS**

[1] Computer aided process control, S.K.Singh, PHI.

[2] Understanding Distributed Process Systems for Control, Samuel Herb, ISA.

[3] Programmable Logic Controllers: Principles and Applications, Webb &Reis, PHI

[4] Distributed computer control for industrial automation, Ppovik Bhatkar, Dekkar Pub

## **DEE-502 PNEUMATIC AND HYDRAULIC SYSTEMS**

### **I Fluid Power, Pumps.**

Basic Properties Of Hydraulic Fluids, Hydraulic Pumps-Classification -Pump types, Hydraulic circuit, Hydraulic actuators, Types of control valves.

**II Pneumatics system-** Basic principles of pneumatics-difference between hydraulics and pneumatics-compressor types, vacuum pumps, air preparation and distribution, Dryers, FRL etc.

### **III Fundamentals of PLCs**

PLC features, Basic Structure, Input and output types, Input and output processing, Programming-logic functions, Latching, sequencing, Timers, internal relays and counters, Shift registers, Master and Jump controls, Data handling, Selection of PLC.

#### **References:**

1. Mechatronics-W.Bolton-Pearson Education.

2. Pneumatic And Hydraulic Systems - Bolton W. Butterworth-Heinemann-1987

3. Programmable Logic Controllers by Thomas E.Kissel

4. Programmable Logic Controller by W.Bolton

## **DEE-503 ELECTRICAL DRIVES**

**1. Electrical Drives:** Introduction, Advantages, Parts of Electrical Drives, Choice of Electrical Drives. Status of AC and DC drives.

**2. Dynamics of Electrical Drives:** Fundamental Torque Equations, Speed Torque conventions and Multi-quadrant operation, Components of load torques, Nature and classification of load torques.

**3. Control of Electrical Drives:** Modes of operation, Speed Control and drive classifications, Closed loop control of drives-Current limit control, Closed Loop Torque Control, Closed Loop Speed Control, Speed Sensing and Current sensing, PLL, Closed Loop Position Control.

**4. DC Drives: Basic** DC motors and their equations, Speed Control-Armature Voltage control, Field flux control and Armature resistance control, Uncontrolled and Controlled Rectifier,

Control below and above base speed, Stepper Motor Drives.

**5. AC drives:** Soft start, Variable Frequency control from voltage sources, VSI induction motor drives, Cycloconverter Control, Closed Loop Speed control of VSI drives, CSI control, Closed Loop Speed control of CSI drives, Comparison of CSI and VSI drives.

### RECOMMENDED BOOKS

- [1]. Fundamentals of Electrical Drives by Gopal K. Dubey- Narosa Publishing House.
- [2]. A first course on Electrical Drives by S.K. Pillai- John Wiley and Sons.
- [3]. John Hindmarsh, Alasdair Renfrew-electrical machines and drives

## DEE -504 LINEAR CONTROL SYSTEMS

**1. Introduction:** Control Systems-Open and Closed Loop Control Systems, Transfer Function, Poles and Zeros of Transfer Function, Procedure for determining the transfer function of any system. Mathematical Modelling of RLC Series Circuit, RLC Parallel Circuit and SMD system.

**2. Block Diagrams & Signal Flow Graphs:** Block Diagram Reduction Rules, Procedure to draw signal flow graphs, Mason's Gain Formula, Drawing signal flow graph from a given block diagram.

**3. Time Response specifications of Control Systems:** Transient & Steady State Response, Input test signals, Time response of zero order, first order and second order systems, steady state error, Steady state error analysis for different type of control systems, sensitivity analysis (a) Effect of transfer function parameter variations in an open loop control system, (b) effect of forward path transfer function parameter variations in a closed loop system, (c) sensitivity of overall transfer function with respect to forward path transfer function and (d) sensitivity of overall transfer function with respect to feedback path transfer function, control actions: Proportional, Derivative, Integral, PID Control.

**4. Stability Analysis of Control System in Time Domain:** Stability, Asymptotic Stability, BIBO Stability, Absolute and Relative Stability, Routh Hurwitz Criterion, Root Locus, Salient Features of Root Locus Plot.

**5. Stability Analysis of Control System in Frequency Domain :** Bode Plot (Logarithmic Plot for transfer functions, Initial slope of Bode plot, Procedure for drawing bode plot and determination of gain margin, phase margin and stability, system identification using inverse bode plot. Nyquist Criterion, Stability Analysis by Nyquist Criterion.

**6. State Variable Model and Analysis:** State Space representation, Block diagram for state equation, Transfer function decomposition, direct, cascade and parallel decomposition, controllability and observability of state space systems.

### RECOMMENDED BOOKS

- [1] Benjamin C.Kuo, "Automatic Control Systems", PHI Learning Private Ltd, 2010
- [2] I.J.Nagrath, M.Gopal, Control Systems Engineering, New Age International Publishers Reprint 2008.
- [3] Krishnaswamy K., "Process Control", New Age International Publishers, New Delhi, 2006.
- [4] Stephanopoulos, G, "Chemical Process Control", Prentice Hall of India, New Delhi, 1990

## DEE- 505 SIGNAL & SYSTEMS

**1. Representation of Signals and Systems:**

Signals, Basic Continuous Time signals, Energy and power signals, System modeling concepts, Linear time invariant systems, Representation of signals in terms of impulses, Discrete time LTI systems continuous time LTI systems, Properties of LTI systems, Systems described by differential and difference equations, Introduction to Sampling theorem of sinusoidal and random signals, Quantization.

### **2. Fourier Analysis:**

Continuous and discrete time Fourier series, Trigonometric & exponential Fourier series, Properties of Fourier series, Parseval's theorem, Line spectrum, Rate of conversion of Fourier spectra, Continuous and discrete time Fourier transforms and its properties, Analysis of discrete time signals and systems, Correlation, Autocorrelation, Relation to Laplace transform.

### **3. Z-Transform:**

Definition of Z-transform and Z-transform theorems, Relation between Z.T. and F.T., Transfer function, Inverse Z-transform, Discrete time convolution, Stability, Time domain and frequency domain analysis, Solution of difference equation.

## **RECOMMENDED BOOKS**

[1] Proakis, J.G. and Manolakis, D.G., Digital Signal Processing Principles Algorithm & Applications, PrenticeHall (2007)

## **DEM-506 ENTREPRENEURSHIP DEVELOPMENT AND MANAGEMENT**

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

**2. 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.

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

**4. 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.

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

## **RECOMMENDED BOOKS**

[1] Entrepreneurship Development by Abhishek Nirjar

[2] Innovation and Entrepreneurship by Peter F Drucker

[3] Intellectual Property Rights by Neeraj Pandey and Khushdeep Dharni

[4] Principles of Management by J S Chandan

## **DEE-507 PNEUMATIC AND HYDRAULIC LAB**

Hardware Exercises: Hands on assembly using standard fittings of different electro-pneumatic & electro-hydraulic components. Learning the hardwiring of Pico PLC with different input elements and solenoid operated Direction Control Valves. Implementing control by programming the Allen Bradley and ABB PLCs fitted on Electro-hydraulic & Electro-pneumatics trainer set-ups. Designing ladder logic for actuation of single as well as multiple pneumatic and hydraulic actuators

such as single acting & double acting cylinders, pneumatic & hydraulic motors using control valves consisting of Direction control valves, pressure control valves & flow control valves.

### **DEE-508 ELECTRICAL DRIVES LAB**

VFD Drives, introduction and use , configurations and parameterization for different industrial applications.

### **DEE-509 PLC PROGRAMMING LAB**

PLC Programming Lab includes, Programming examples using Bit Logic Instructions, Arithmetic Instructions, Comparator Instructions, Timer Instructions, Counter Instructions, Logical Instructions, Cascading of Timers & Counters, interlocking, latching, case studies etc.

### **DEE 510- AUTOCAD ELEC. DESIGN LAB**

AutoCAD (Electrical) Lab includes, Introduction to Design Centre as per electrical and electronic components, 2D Basic and 3D Advanced Commands, Designing 2D Electrical/ Electronic Control & Power Circuits, Panel Designing, Designing block diagram of drawing information, Making Some Mechanical 3D design of contactor, Relay, PLC, SMPS etc.

### **DEE 511- INDUSTRIAL TRAINING**

The students undergo 8 weeks industrial training on after 4<sup>th</sup> 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

### **DEE 512- MINOR PROJECT**

Minor Project involves, Conceptualization & Formulation of Idea, Costing, Simulation if any, Design Considerations. The following Evaluation Criterion would be followed:

<b>Criterion</b>	<b>Marks</b>
Functioning of the Developed Model	50
Minor Project Report	25
Presentation & Viva Voce	25
Total	100

It is expected that the students shall continue the same project in their sixth semester.

## **SIXTH SEMESTER**

### **DEE-601 INNOVATION, DESIGN AND MANUFACTURING**

**1. 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

**2. 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

**3. 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

**4. 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.

**5. 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.

## **DEE-602 INDUSTRIAL ENGINEERING AND MANAGEMENT**

**1. Work Measurement and Work Study :**Work measurement, Techniques- Production study, Time study, Standard time-Rating factors- Work sampling Work study, Techniques- Human factors-Work study and productivity-method study, Techniques and procedures- charging Techniques-Motion economy principles- SIMO chart.

**2. Plant Layout and Material handling:** Plant location, site selection- Plant layout types, need, factors influencing the layout - Tools and techniques for developing layout, process chart, flow diagram, string diagram, Template and Scale models- Layout Planning procedure-Assembly line balancing. Material Handling, scope and importance- Types of material handling systems-factors influencing material handling- methods of material handling

**3. Work Design Ergonomics, Production & Productivity :** Introduction to work design-Work design-for increased productivity, Introduction to job design-Effective job design-Environmental factors, organizational factors & behavioral factors. Ergonomics -Objectives' system approach of ergonomic model-Man-machine system. Production and productivity-Definition of production, function and type of production- Definition of productivity- Productivity measurement.

**4. Production Planning and Control :** Objectives of PPC- Functions of PPC- Aspects of product development and design- Process Planning-Principles of Standardization, specialization, Simplification-Group Technology- Optimum Batch size- ABC analysis- Value Engineering.

**5. Wages and Incentives:** Wages and salary administration- Meaning principles- Techniques of wage fixation- Job evaluation- Merit rating- Methods of wage payment. Incentive scheme, Types, Advantages and disadvantages-Productivity base incentives, Case Example- Evaluation of incentive scheme.

#### **RECOMMENDED BOOKS**

- [1] Khanna.O.P, "Industrial Engineering and Management", Khanna publishers, New Delhi 1999.
- [2] Samuel Ellen, "Elements of Production Planning and Control", McMillan and Co., 1971.
- [3] Kumar.B, "Industrial Engineering", Khanna Publishers, New Delhi, 1998.

### **DEE-603 INDUSTRIAL ROBOTICS**

**1. Introduction:** Advantages and applications, Laws of robotics , Basic structure of robots, Applications, Work space , Accuracy, Resolution , Repeatability of robot , NC Vs Robot, , Harmonic drives- introduction,.

**2. Classification and Structure of Robotic Systems:-** PTP and continuous path systems, control loops of robotic systems, The manipulator- Cartesian, cylindrical, spherical, Articulated, Direct and Indirect drives, Continuous Path Robot Systems

**3. Robot Kinematics:** Introduction to Manipulator Kinematics, Forward and backward transformation for a robot.

**4. Robot Programming:** Manual Teaching, Lead-Through Teaching, Programming with Graphics .

#### **RECOMMENDED BOOKS**

- [1] Introduction to Robotics by Saeed Benjamin Niku, JOHN WILEY & SONS, INC.
- [2] Introduction to Robotics by John J Craig, Pearson Education International
- [3] Deb, Sathya Ranjan, "Robotics Technology and Flexible Automation", Sixth Edition, Tata McGraw-Hill, New Delhi, 2003.
- [4] Groover, M.P., "Industrial Robotics: Technology, Programming and Applications", McGraw-Hill, New York, 2003.

### **DEE-604 COMPUTER NETWORKS**

**1. Networks Basics:** What is network, Models of network computing, Networking models, Peer-to-peer Network, Server Client Network, LAN, MAN and WAN, Network Services, Topologies, Switching Techniques

**2. OSI Model:** Standards, OSI Reference Model, OSI Physical layer concepts, OSI Data-link layer concepts, OSI Networks layer concepts, OSI Transport layer concepts, OSI Session layer concepts, OSI presentation layer concepts, OSI Application layer concepts,

**3. Introduction to TCP/IP:** Concept of physical and logical addressing, Different classes of IP addressing, special IP address, Sub netting and super netting, Loop back concept,IPV4 and IPV6 packet Format, Configuring IPV4 and IPV6,

**4. Protocol Suites:** Models and Protocols, Network IPX/SPX, Intranet Protocols,



**5. Network Architecture:** ARC net specifications, Ethernet Specification and Standardization, 10 Mbps (Traditional Ethernet), 10 Mbps (Fast Ethernet) and 1000 Mbps (Gigabit Ethernet), Introduction to Media Connectivity (Leased lines, ISDN, PSTN, RF, VSAT, )Optical and IPLC),

**6. Network Connectivity:** Network connectivity Devices, NICs, Hubs, Repeaters, Multiplexers, Modems, Routers and Protocols, Firewall, ATM, VOIP and Net-to-Phone Telephony, Laws and Protocols.

**7. Network Printing & Network Administration:** Print Services, Network Administration / Security, Client/Server Technology, Server Management, RAID management and mirroring, Cryptography.

**8. Network Trouble Shooting Techniques:** Trouble Shooting process, Trouble Shooting Tools: PING, IPCONFIG, IFCONFIG, NETSTAT, TRACEROUT, Wireshark/ Dsniffer/ Pcop

**9. Wireless Networking:** Basics of Wireless: Wireless MAN, Networking, Wireless LAN, Wi-Fi, WiMax (Broad-band Wireless) and Blue-Tooth technology.

### **RECOMMENDED BOOKS**

[1] Computer Networking: A Top - Down Approach, by Ames Kurose, Keith Ross

[2] Computer Networks - Andrew S Tanenbaum

[3] Computer Networks: A Systems Approach Book by Bruce S. Davie and Larry L. Peterson

[4] TCP/IP Tutorial and Technical Overview, (IBM Redbook)

### **DEE-605 MICROCONTROLLER AND ITS APPLICATIONS**

**1. Introduction:** 8051 Micro controller: Comparison of Microprocessor and Micro controller, micro controller and embedded processors, overview of 8085 families.

**2. 8051 Assembly Language Programming:** Assembling and running an 8051 program. Data Types and directives. 8051 flag bits and PSW register. Register banks and stack. 8051 Assembly languages programming – addressing modes Instruction set- Data transfer instructions, Arithmetic instructions, Logic Instructions– byte and bit level instructions, Jump, Loop , CALL instructions & Programming of 8051.

**3. I/O Port programming:** Addressing modes and accessing memory using various addressing modes. Arithmetic instructions and programs, Logic instructions and programs, Single bit instructions and programming, Timer/counter programming in the 8051

**4. Serial Communication:** 8051 connection to RS 232, 8051 serial communication programming.

**5. Real World Interfacing:** LCD, ADC and sensors, Stepper motor, keyboard, DAC and external memory, Case Studies.

### **RECOMMENDED BOOKS**

[1]. Muhammad Ali Mazzi, Jancie Gillispe Mazid “The Microcontroller & Embedded Systems”, Pearson Education, 2000.

[2]. Kenneth J. Ayala, “The 8051 Microcontroller – Architecture, Programming and Applications”, West Publishing Company.

### **DEE606- MEASUREMENT & INSTRUMENTATION**

**1. Measurements & Measuring Systems:** Significance of Measurements, Methods of Measurement, Direct Methods. Indirect Methods, Mechanical, Electrical and Electronic Instruments, Classification of Instruments: Analog and Digital Functions of Instruments and Measurement Systems, Applications of Measurement Systems, Elements of a Generalized Measurement.

**2. Characteristics of Instruments and Measurement Systems:** Calibration, Static Characteristics, Errors in Measurements, True Value, Static Error. Static Correction, Scale Range and Scale Span. Error Calibration Curve. Reproducibility and Drift. Repeatability, Noise, Accuracy and Precision. Indications of Precision, Significant Figures, Range of Doubt or Possible Errors and Doubtful Figures, Static Sensitivity. Instrument Efficiency, Index Scale, and Index Number, Linearity. Hysteresis, Threshold, Dead Time, Dead Zone, Resolution or Discrimination.

**3. Errors in Measurements:** Types of Errors, Gross Errors, Systematic Errors, Instrumental Errors, Environmental Errors, Observational Errors, Random (Residual) Errors.

**4. Measurement of Electrical Quantities :**Introduction, Cathode Ray Tube, (CRT), Electron Gun, Deflection Plates, Screens for CRTs, CRT Graticule, time Base Generators, Ammeter, Voltmeter, Ohmmeter, Difference between PMMC and PMMI Instruments, Electrodynamometer Wattmeters, Circuits. Single Phase Induction Type Watt-hour Meters, Construction, Theory and Operation, Single Phase Electrodynamometer Power Factor Meter

**5. A.C. Bridges:** General form of AC bridge, General Equation for Bridge Balance, Measurement of self inductance, Mutual Inductance, Capacitance and Frequency

**6. Indicating Instruments:** Digital indicators, Analog Indicators, Pen recorders, chartless recorders, Indicating lamps and alarm Annunciators.

#### **RECOMMENDED BOOKS:**

[1] Measurements and instrumentations by A.K Sawney, Dhanpat Rai Publications

#### **DEE- 607 MECHATRONICS LAB**

Introduction to Industrial Sensors: Study and use of Industrial transducers for measurement of presence/absence of objects, displacement, color, metallic/ non-metallic objects etc. for Mechatronics Applications. Understanding the wiring configuration and color coding concepts of different I/O components used in material handling and packaging industries. Understanding the different I/O components such as Sensors, Motors, conveyors used in the Cube Assembly system and understanding the drawings. Dismantling and assembly of Cube Assembly system and to carry out the Hardware interfacing of Different types of 2- wire, 3- wire, 4-wire sensors, NO and NC type push buttons, selector switches with the programmable logic controller and driving different types of motors such as DC geared motor, stepper motor and servo motor through the PLC by using relays at the output of the PLC. Also driving different types of solenoid valves of the DCVs and controlling of conveyors using PLC.

#### **DEE-608 EMBEDDED SYSTEMS LAB-I**

Microcontroller Lab involves, Simulator and Programmer for 8051, Study of 8051 Micro controller kits, Writing assembly language programs like Addition of two numbers lying at two memory locations and display the result, multiplication of two numbers lying at memory location and display the result, to check a number for being ODD or EVEN and show the result on display, to split a byte in two nibbles and show the two nibbles on display, to arrange 10 numbers stored in memory location in Ascending and Descending order, to find a factorial of a given number, Study of Interrupt structure of 8051 micro controllers,

#### **DEE 609- ORCAD LAB**

OrCAD: Making circuit diagram in CIS capture, Layout Designing: Single sided and double Sided, methods to import MNL file, ways to draw board outlines, Placing of components: Manual, Auto place, Routing, Changing of Track width, Selection of layers, Creating Gerber file and print out circuit designing, PCB layout designing of different circuit diagrams using OrCAD.

### DEE-610 ROBOTICS LAB-I

Introduction KUKA SIM-Pro simulation software for Simulation of KUKA robot motion.  
Introduction to Industrial Robot, Basic Industrial Robot hardware practice.

### DEE-611 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>

\* 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.

### DEE-612 MAJOR PROJECT

Major Project includes, Development of an Electro-Mechanical System. Trouble shooting and testing. Submission of Project Report & Seminar. The following Evaluation Criterion would be followed:

Criterion	Marks
Functioning of the Developed Model	50
Major Project Report	25
Presentation & Viva Voce	25
Total	100

### Overall Marks of ISTC Diploma in Electronics Engineering – 3 Yrs. Course

Semester	I	II	III	IV	V	VI	Grand Total
Max. Marks	1200	1200	1000	1000	1200	1200	6800

## SEVENTH SEMESTER

### **DEE-701 PROCESS INSTRUMENTATION & SAFETY**

**1. Temperature Measurement:** Transducers used for temperature measurement, thermocouple and its configuration, bimetallic thermo meter, resistance temperature detector & compensation techniques, Thermistor & its types, radiation and optical pyrometer. Comparison of these Temperature sensors.

**2. Pressure Measurement:** Transducers used for pressure measurement, Introduction to static and dynamic pressure, unit of pressure and conversions, pressure standards, principle of working, material of Construction, advantages and limitations of various instruments based upon elastic transducers like ordinary and diaphragm, bourdon tube, bellows, capsules etc. sealed pressure gauges, pressure transmitters, pressure switches and strain gauge pressure pick-ups, methods for measurement of vacuum and high pressure.

**3. Flow Measurement:** Transducers used for flow measurement, Basic properties of fluids, principle of operation. construction, classification, characteristics of various measurement methods, variable head meters, orifice plate & its types, venturi tube, flow nozzle, pitot tube, rotameter and its types, magnetic meter, turbine meter, vortex meter, mass flow meter & its types. Ultrasonic meter, thermal flow meter, Positive displacement meters.

**4. Level Measurement:** Transducers used for level measurement, Importance of level measurement, principle of working, material of construction, advantage and limitation of various instruments such as visual level indicators, ordinary float type using string and pulley, purge method of measuring level Buoyancy method, resistance probes for level measurement, capacitive level meter, ultrasonic level measurement, Gamma rays level measurement, level limit switches, level measurement using open & closed vessel.

**5. Control Valves:** Types of control valves viz. globe, diaphragm, gate, ball, butterfly, plug valves. Their specifications, selection consideration & applications.

**6. Industrial Safety:** Fire Prevention and Control, Handling of Fire Accidents, Electrical Safety, Environmental Safety, Various safety equipments and their constructional features, Maintenance and repair of safety equipments, Safety in High Pressure Operations, Safety Management.

#### **RECOMMENDED BOOKS:**

[1] Process Control Instrument Johnson PHI

[2] Instrumentation Handbook Kallan Mc Graw Hill

[3] Instrument Measurement & Analysis Nakara PHI

[4] Measurement Systems Applications E O Deoblin Mc Graw Hill IE-6201 SENSOR & SIGNA

[5] Sensors and actuators by Clerence D. Silva

### **DEE-702 EMBEDDED SYSTEM DESIGN**

**1. Introduction:** Introduction to ARM, PIC and AVR , Arduino Microcontrollers, Specifications, Types, Difference between ARM, AVR, PIC & 8051 Microcontrollers.

**2. ARM microcontroller:** Introduction, basics, features, pin diagram, Architecture and memory organization of ARM Controllers, interfacing of ARM microcontroller using flow code.

#### **3. PIC microcontroller**

Introduction, basics, features, pin diagram, Architecture and memory organization of PIC Controllers. PIC 16c6x, 16c7x. 18x, 24x PIC, introduction to flow code, interfacing of PIC microcontroller using flow code.

#### **4. AVR microcontroller**

Introduction, basics, features, pin diagram, Architecture and memory organization of AVR Controllers.

## **5. Arduino microcontroller & Programming**

Introduction, basics, features, pin diagram, Architecture and memory organization of Arduino Controllers. Integration of sensors & actuators with Arduino.

**6. Case Studies:** Case Studies using ARM, PIC, AVR and Arduino Microcontrollers.

## **RECOMMENDED BOOKS**

[1] ARM A-32 Assembly Language by Bruce Smith

### **DEE 703- EMERGING TECHNOLOGIES-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

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

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.

### **DEE-704 ROBOTICS LAB-II**

Advance work on KUKA Simpro simulation Software- Programming the Industrial Robot for application.

### **DEE-705 EMBEDDED SYSTEMS LAB-II**

Introduction to the Matrix solution hardware kit, working exercises on Hardware, Introduction and Exercises on Control Area Network BUS system and some more advanced kits. Introduction of Flow code, designing controller's logic by using flow code, basic introduction to the 3x4 Keypad, 16X2 LCD, 8 Bit Switch Array, 8 Bit LED Array, 7 Segment Quad LED.

### **DEE -706 PROCESS INSTRUMENTATION AND SAFETY LAB**

Detailed technical specifications of different types of field devices such as pressure transmitters, flow transmitters, temperature transmitters, PH & conductivity transmitter, safety shut off valve & control valve. Wiring of these field devices with the PLC using different communication protocols using 4 to 20 mA, Highway Addressable Remote Transducer (HART) protocol, Foundation Fieldbus protocol, Profibus, Serial communication & illustrating differences between these protocols. Also showing the using of Wireless gateway based on wireless HART protocol. Programming using DeltaV software for acquiring data from the transmitters, for modifying & scaling the acquired data & communicating the modified data to the Discrete Valve controller to control the control valve. Implementing PID to run the flow control loop in the system & configuring alarms for undervalue and overvalue of the acquired parameter value. Programming the Emerson Workstation used as HMI by creating dynamos, creating control modules & creating function blocks in the control modules & linking control modules to dynamos and by linking the function blocks with the device signal tags.

## **DEE-707 INDUSTRIAL PROJECT SEMINAR**

For Advanced Project Seminar each student has an individual mentor. The seminar topic must aim at design of a Advanced Mechatronics systems using the concepts related to the branch of the study. The student is expected to deliver a seminar highlighting the Idea formation, Design & Simulation and costing and procurement involved, the same project would be carried forward to the eighth semester.

The following Evaluation Criterion would be followed:

<b>Criterion</b>	<b>Marks</b>
Problem Formulation	30
Design / Methodology/ Simulation	40
Seminar	30
Total	100

## **DEE 708- INDUSTRIAL TRAINING**

The students undergo 8 weeks industrial training on after 6<sup>th</sup> 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

## **DEE-709 PROFESSIONAL PRACTICE-I**

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
Total	200

## **EIGHTH SEMESTER**

### **DEE 801- INSTRUMENTATION APPLICATIONS**

#### **1. Industrial Instrumentation**

Temperature measurement - Radiation measurement - Pressure measurement - Measurement of viscosity - Measurement of density - Flow and Level Measurement - Basics and Applications - Power and Energy Measurements

#### **2. Analytical and Optical Instrumentation**

Mass spectrometry. UV, visible and IR spectrometry. X-ray and nuclear radiation measurements. Optical sources and detectors, LED, laser, Photo-diode, photo-resistor and their characteristics. Interferometers, applications in metrology. Basics of fiber optics. Industrial applications of

LASERS: Lasers for measurement of distance and length, current and voltage measurement. Material processing: Laser heating, melting, scribing, splicing, welding, calculation of power requirements.

### **3. Biomedical Instrumentation**

Biomedical instruments, EEG, ECG and EMG. Clinical measurements. Ultrasonic transducers and Ultrasonography. Principles of various medical imaging systems, Patient monitoring systems: Intensive cardiac care, bedside and central monitoring systems, patient monitoring through telemedicine, implanted transmitters, telemetering multiple information.

### **RECOMMENDED BOOKS**

[1] Doebelin E.O., Measurement Systems - Application and Design, Tata McGraw Hill publishing company, 2008.

[2] Patranabis D, Principles of Industrial Instrumentation, Tata McGraw Hill, 3rd Edition, 2010.

[3] Leslie Cromwell, Fred J. Weibell and Erich A. Pfeiffer, Biomedical Instrumentation and Measurements, Prentice Hall of India, New Delhi, 2007 & Web resources

## **DEE-802 ADVANCE DIGITAL SIGNAL PROCESSING**

### **1. Introduction to Fast Fourier Transforms:**

Discrete Fourier transform, Properties of DFT, Fast Fourier transforms, Divide and Conquer Approach, Decimation in time and decimation in frequency, Radix-4FFT, Linear Convolution, Circular Convolution, Power spectrum and correlation with FFT

**2. Design of Digital Filters:** Basic principles of Filters and Filtering, Different types of the filters, Problems associated with Passive filters, Difference between analog and digital filter design.

**3. Design of FIR Filters:** Symmetric and Antisymmetric FIR filters, Linear phase concept, Design of ideal and practical FIR filter (LPF, HPF, BPF and BRF) without using Window functions and with window functions, Comparison of window functions, Design of FIR filters using frequency sampling methods, Design of digital differentiator, Structure for realizing digital FIR filters.

**4. Design of IIR Filters :** Butterworth and Chebyshev approximation, Design of Butterworth (Type 1 and II) Lowpass filters using approximation of Derivative, Impulse invariance and Bilinear Transformation, Frequency warping effect, Prewarping, Frequency transformation in both analog and digital domain. Difference between IIR and FIR filters, Structure for realizing digital IIR filters.

### **RECOMMENDED BOOKS**

[1] J.G. Proakis, D.G. Manolakis and D. Sharma, Digital Signal Processing, Pearson, 3rd edition, (2013).

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

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.

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.

Industry 4.0: Introduction to Industry 4.0 standards

**DEE -804 SMD AND REWORK TECHNOLOGY LAB**

SMD Lab: Study of different type of SMD components, Mounting and testing of SMD components, Fabrication of Regulated power supply using SMD components, Study of SMD instruments.

**DEE 805- DSP LAB**

DSP Using LabView Lab includes, A graphical programming approach (LabVIEW) to DSP system-level design, DSP implementation of appropriate components of a LabVIEW designed system, Providing system-level, hands-on experiments for DSP lab or project courses

**DEE-806 INDUSTRIAL SERVO LAB**

Introduction of 3 phase Industrial AC Servo, Programming of Servo using PC, Parameter setting via Local control panel, Parameter setting by remote operations, Different mode of controls like speed control mode; torque control mode; position control mode, Different input modes like HMI input; Potentiometer input, Communication between HMI to Servo, Communication between Servo to PLC, communication between Servo-HMI-PLC.

**DEE-807 PROFESSIONAL PRACTICE –II**

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.

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

**DEE-808 INDUSTRIAL PROJECT**

Criterion	Marks
Functioning of the Developed Model	100
Project Report	25
Presentation	25
Total	200

**Overall Marks of ISTC Advanced Diploma in Mechatronics & Industrial Automation – 4 Yrs. Course**

Semester	I	II	III	IV	V	VI	VII	VIII	Grand Total
Max. Marks	01200	1200	1000	1000	1200	1200	1000	1000	8800



