CURRICULAUM

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**Note:** For setting of question paper,

Unit No. 01, 02 and 03  --------------- Section A
Unit No.04, 05 and 06  --------------- Section B
Unit No.07, 08 and 09  --------------- Section C

Also refer table of specification
CONTENTS

Unit No 01

Units, Dimensions & Measurements : ( 6 Hrs)

Physical quantity, Fundamental & derived Physical quantities, Unit of physical quantity, systems of units, fundamental & derived units, S.I units, Basic quantities, their S.I units, & symbols, supplementary quantities, their S.I units & symbols, Prefixes for multiples & sub multiples with their symbols, Advantages of S.I units.

Dimensions of a physical quantity examples:- Steps to write dimensions, Dimensional formula Dimensional equation, Applications of dimensional equation, Limitations (Disadvantages) of dimensional equations (analysis).

Measurement:- Principle of vernier, Neat diagram of slide calipers & its parts, Zero error & its correction, Least count, Reading MSR & VSR (CVD), use of vernier calipers for measurements, problems on vernier calipers.

   Principle of screw & nut (Micrometer principle), Neat diagram of screw gauge & its parts, Zero error, zero correction, Pitch, least count, reading PSR & HSR, use of screw gauge for measurements, problems on screw gauge.

Unit No 02

Basics of Dynamics (6 Hrs)

Recapitulation of equations of motion, **Newton’s 1st law of motion**, **Force**, basic forces in motion, gravitational force, electrostatic force, electromagnetic force, nuclear force, Difference between strong interaction & weak interaction, **Inertia**, types of inertia (inertia of rest, inertia of motion, inertial of direction), **Momentum**, **Newton’s 2nd law** of motion, measurement of force using second law, simple problems on F = ma and equations of motion, **Impulse of force**, Impulse as the product of force and time, also impulse as the difference of momentum, examples of impulse, simple problems on impulse, **Newton’s 3rd law of motion** and its examples. **Law of conservation of momentum**, Statement, proof of this law using Newton’s laws, simple problems

**Friction**: Cause of friction, types of friction, static friction, limiting friction, kinetic friction, rolling friction, sliding friction., laws of limiting friction, coefficient of friction advantages and disadvantages of friction, preventive methods of friction,
Unit No 03

Basics of Statics (6 Hrs):

Scalar & Vector quantities with examples, geometrical representation of a vector, concurrent & parallel vectors, Resultant, equilibrium & equilibrant of vectors,

Law of parallelogram of vectors:- Statement, explanation, expressions for magnitude & direction of the resultant of two concurrent vectors, simple problems, resolution of vectors, explanation, simple problems, Law of triangle of vectors, explanation, converse of law of triangle of vectors, law of polygon of vectors, explanation.

Lami’s theorem - Explanation, Experiments to verify law of parallelogram of forces, converse of law of triangle of forces, & Lami’s theorem. Problems on above laws.

Moment of a force, positive & negative moments, parallel forces, Like & unlike parallel forces, couple, moment of a couple, practical examples of couple, work done by a couple (equation only), Resultant of two like & unlike parallel forces, condition of equilibrium of coplanar parallel forces, Experiment to verify the conditions of equilibrium of co-planar parallel forces. Problems

Unit No 04

Properties of Solids and Liquids (10 Hrs):

Plasticity and Elasticity, examples, Deformation in bodies by the action of external forces, Stress, Types of stress, Tensile stress, example, Compressive stress, example, Shear stress, example, Strain, Types of strain, Tensile strain-examples, Volume strain-examples, Shear strain-examples, Hooke’s Law, Stress-strain graph with explanation., Elastic co-efficient Modulus of elasticity, Young’s modulus of elasticity-formula, Bulk modulus of elasticity-Formula, Rigidity modulus of elasticity-formula, Explanation of factor of safety Compressibility, Poisson’s ratio, Experiment to determine Young’s modulus of elasticity by Searle’s method, problems.

Properties of Liquids: Liquid thrust, Pressure, Expression for pressure at a point inside a liquid, simple problems, Cohesion, Adhesion, nature of meniscus and angle of contact – examples., Surface Tension-Explanation, formula unit and dimension, practical examples of surface tension, applications of surface tension, Factors affecting surface tension, capillarity and its applications, expression for surface tension in case of capillary rise, Determination of surface tension by capillary rise method, simple problems. Viscosity- Explanation with example, viscous force, factors affecting viscosity of gasses and liquids, co-efficient of viscosity , SI unit and dimensions, Experiment to determine co-efficient of viscosity by Poisulle’s method, Applications of viscosity, simple problems.
Unit No 05

Heat and properties of gases (5 Hrs):-

Heat, temperature, S.I units, difference between heat and temperature, calorie.

Modes of transform of heat:- Conduction, Convection, Radiation examples, good conductors of heat & insulators, examples, Applications of conduction, convection & radiation.

Specific heat of a substance S.I unit, Heat capacity ( thermal capacity or specific heat capacity of body)

Boyle’s law, statement & mathematical form, Gay-Lussac’s law Statement and expression, Charles law, Statement and expression, Absolute (Kelvin) scale of temperature, conversion formula to Celsius scale from absolute scale,
Perfect gas equation (combined gas equation), Specific heat of gas at constant volume (C_v) Specific heat of gas at constant pressure (C_p), relation between C_p & C_v
[ (i) ratio of specific heat (ii) Meyer’s relation ( no derivation) ]


Unit No 06

Wave motion (12 Hrs)

Vibratory motion, periodic motion, definitions of period, frequency, and amplitude for a vibrating particle, Simple Harmonic Motion, Explanation of SHM(motion of the foot of the perpendicular), Obtaining expression for displacement, velocity and acceleration of a body executing SHM,

Wave Motion- Explanation of a wave and wave motion with examples, definitions of wave velocity, wave period, wave frequency, and wave length, derivation of V = nλ problems. Types of waves transverse and longitudinal waves with examples, mechanical and non mechanical waves with examples. Mode of transfer of longitudinal waves ( sound wave) in air. Velocity sound in a gas, Newton’s assumptions and formula Laplace’s assumptions and corrected formula. Effect of temperature, pressure and humidity on the velocity of sound, problems. Stationary waves with examples, characteristics of stationary waves.
Resonance. Explanation of free, forced vibrations with examples. Explanation of resonance, practical examples of resonance. Experiment to determine velocity of sound in air by resonance air column method. Problems.

Beats, Beat frequency, applications of beats, problems.

Laws of transverse vibrations of stretched strings statements of the laws with relevant formula. Experiments to determine frequency of the tuning fork using sonometer by
(i)Absolute method and (ii) Comparison method. Problems

Musical note and Noise:- examples , characteristics of musical note.

Acoustics of buildings Echo, Reverberation, Interference, resonance. Reverberation time. Sabine’s formula and explanation, absorption coefficient of materials. Remedies for defects.
Unit No 07

**Physical Optics (12 Hrs)**

**Introduction to theories of light**, Newton’s corpuscular theory, Huygens wave theory, Maxwell’s electromagnetic theory, Planck’s quantum theory, Dual nature of radiation.

**Interference**, theory of interference, Amplitude of resultant wave, condition for constructive interference, condition for destructive interference, condition for sustained interference, Young’s double slit experiment, expressions for path difference and fringe width, intensity distribution in interference fringe, simple problem on fringe width & path difference.

**Diffraction**, classification diffraction, Fresenel’s diffraction, Fraunhoffer diffraction, difference between them, Huygen’s principal, wave front, diffraction with white light, difference between Interference and Diffraction, **Concept of resolving power of an optical instrument**, Rayleigh criteria, Resolving power of a microscope, and its expressions in terms of wave length, resolving power of telescope, expression for resolving power of in terms of wave length, simple problems.


Unit No 08

**Modern physics (9Hrs)**

**Methods of electronic emission**

Thermo ionic emission, photoelectric emission, field emission, and secondary emission. Experiment to study photoelectric effect, Experimental results (four results). Four laws of photoelectric emission, Einstein’s photoelectric equation.

**Photoelectric cells**, Photo emissive cells, Photo voltaic cells, Photo conductive cells. Applications of photo electric cells. **Electron microscope** Principal of electron microscope, focusing by magnetic lens, construction and working, uses of electron microscope, **Atomic forced microscope** simple working of atomic forced microscope, advantages of atomic forced microscope over electron microscope.


**Lasers:** Induced absorption, spontaneous emission, stimulated emission. Principal of laser, population inversion, optical pumping. Properties of lasers. Applications of lasers.

**Radio activity:** Introduction, experiment to demonstrate three types of radiations. Properties of three types of radiations. Applications of radio activity in the field of agriculture, medicine, biology and geology.
Unit No 09

Engineering chemistry (8 Hrs)

Pollution:- Air pollution, air pollutants ( SO₂, H₂S, HF, NO₂, CO, dust), harmful effects. Acid rain and its effects (basic ideas). Other effects of air pollution, Green house effect, global warming, effects of global warming, basic ideas, ozone layer, importance, causes of depletion of ozone layers (no equation). Effects of ozone layer depletion control of air pollution

Water pollution, causes (sewage, effluents, algae, micro organisms), their harmful effects. Their control. Sewage problem and disposals

Corrosion, electrochemical theory of corrosion, formation of galvanic cells, concentration cells.

Methods of prevention of corrosion-Alloying, surfaced coating, galvanizing, electroplating, anodizing, cathodic protection.

\( \text{pH} \) of a solution, water as weak electrolyte, Hydrogen ions, hydroxyl ions. Acidic solution, basic solution and neutral solution, concentration of \( \text{H}^+ \) ions. Ionic product of pure of water, ionic product of acidic, basic and neutral solution. \( \text{pH} \) scale. \( \text{pH} \) for neutral acidic and basic solution, \( \text{pH} \) values of some important solutions. Applications of \( \text{pH} \)
First/Second Semister  
Subject: APPLIED SCIENCE  

code no:  
Contact Hours: 05 Hrs/week                                Contact Hrs/Semister: 80

Unit No. 01     UNITS, DIMENSIONS AND MEASUREMENTS       (6 Hrs)

GENERAL OBJECTIVES

1.1 To understand the concept of Physical Quantities and their units.
1.2 To understand the characteristics of different physical quantities.
1.3 To use appropriate measuring instruments

SPECIFIC OBJECTIVES

1.1.1 Define a physical quantity
1.1.2 Distinguish between fundamental and derived physical quantity.
1.1.3 Define unit of a physical quantity.
1.1.4 List different system of units.
1.1.5 List the fundamental units.
1.1.6 List the derived units.
1.1.7 Define S.I units.
1.1.8 List the basic quantities.
1.1.9 Write the basic units and symbols for them.
1.1.10 List the supplementary units and symbols for them.
1.1.11 Write the supplementary units and symbols for them.
1.1.12 Write the prefix for multiples and submultiples in S.I system.
1.1.13 State the advantages of S.I units.
1.2.1 Define dimensions of physical quantity.
1.2.2 Write the examples of dimensions of physical quantities.
1.2.3 State the steps used for writing the dimension of a physical quantity.
1.2.4 Define dimensional equation (dimensional formula) for a physical quantity.
1.2.5 State the advantages of dimensional equation.
1.2.6 State the disadvantages (limitations) of dimensional equation.
1.3.1 Define measurement
1.3.2 List the instruments used to measure accurately.
1.3.3 Define the Least Count of measuring instruments.
1.3.4 Define principle of vernier.
1.3.5 Identify the parts of a slide calipers.
1.3.6 Explain about zero error and its correction in the case of slide calipers.
1.3.7 Define least count of vernier calipers.
1.3.8 Describe the measurement of MSR and VSR (CVD).
1.3.9 State the uses of vernier calipers
1.3.10 Solve measurement problems on vernier calipers.
1.3.11 Define principle of screw and nut (micrometer principle).
1.3.12 Identify the parts of screw gauge and label its parts.
1.3.13 Explain for writing zero error and zero correction
1.3.14 Define pitch of a screw
1.3.15 Define least count of a screw gauge
1.3.16 Explain measurement of PSR and HSR for screw gauge.
1.3.17 Solve measurement problems on screw gauge.

Unit No.02 BASICS OF DYNAMICS 06 Hrs

GENERAL OBJECTIVES

2.1 To revise equation of motion learnt in high school classes and to apply them to Solve problems.
2.2 To comprehend Newton’s laws of motion.
2.3 To understand friction.

SPECIFIC OBJECTIVES

2.1.1 Review four equations of motion
2.1.2 State the meaning of the quantities involved in equations
2.1.3 Solve problems on equations of motion
2.2.1 State Newton’s First law
2.2.2 Define force
2.2.3 Define gravitational force.
2.2.4 Define electrostatic force.
2.2.5 Define electromagnetic force.
2.2.6 Define nuclear force.
2.2.7 Differentiate between strong and weak interaction.
2.2.8 Define inertia.
2.2.9 Define inertia of rest.
2.2.10 Give examples for inertia of rest.
2.2.11 Define inertia of motion.
2.2.12 Give examples of inertia of motion.
2.2.13 Define inertia of direction.
2.2.14 Give examples of inertia of direction.
2.2.15 Define momentum.
2.2.16 State Newton’s Second law of motion.
2.2.17 Review F= ma
2.2.18 Solve problems on F= ma
2.2.19 Define impulse as a product of force and time.
2.2.20 Write S.I unit and dimensions of impulse.
2.2.21 Obtain impulse as a difference of momentum.
2.2.22 Write examples for impulse.
2.2.23 Solve problems on impulse.
2.2.24 State Newton’s Third law
2.2.25 Give examples for Third law.
2.2.26 State law of conservation of momentum.
2.2.27 Prove the law of conservation of momentum using Newton’s laws.
2.2.28 Solve simple problems.
2.3.1 Define friction.
2.3.2 Point out the causes of friction.
2.3.3 List the types of friction.
2.3.4 Define static friction.
2.3.5 Define limiting friction.
2.3.6 Define kinetic friction.
2.3.7 Define rolling friction.
2.3.8 Define sliding friction.
2.3.9 State four laws of limiting friction.
2.3.10 Define coefficient of friction.
2.3.11 Write the advantages of friction.
2.3.12 Write the disadvantages of friction.
2.3.13 Discuss the preventive method of friction.

Unit No. 03        BASICS OF STATICS                                              06 Hrs

GENERAL OBJECTIVES

3.1 To understand the composition, resolution and equilibrium of vectors.
3.2 To understand moment of a force, couple and parallel coplanar forces.

SPECIFIC OBJECTIVES

3.1.1 Define a scalar quantity with examples.
3.1.2 Define a vector quantity with examples.
3.1.3 Represent a vector quantity geometrically.
3.1.4 Define concurrent and nonconcurrent vectors.
3.1.5 Define resultant of a two or more concurrent vectors (forces).
3.1.6 Define equilibrium of vectors.
3.1.7 Define equilibrant.
3.1.8 Write the relation between resultant and equilibrant.
3.1.9 State and explain the law of parallelogram of vectors.
3.1.10 Obtain expressions for the magnitude and direction of the resultant of two vectors acting at a point.
3.1.11 Explain resolution of vectors.
3.1.12 Solve problems on parallelogram law and resolution of vectors.
3.1.13 State and explain the converse of the law of triangle of vectors.
3.1.14 State and explain the law of polygon of vectors.
3.1.15 State and explain Lami’s theorem.
3.1.16 Describe experiments to verify the law of parallelogram of vectors and the converse of the law of triangle of vectors and Lami’s theorem.
3.1.17 Solve problems on law of triangle of vectors, Lami’s theorem.
3.2.1 Define moment of force.
3.2.2 Write S I unit and dimensions of it.
3.2.3 Define positive and negative moment of force.
3.2.4 Define couple and moment of a couple.
3.2.5 Write practical applications of couple.
3.2.6 Define like and unlike parallel forces.
3.2.7 Explain the resultant of like parallel forces.
3.2.8 Explain the resultant of unlike parallel forces.
3.2.9 Explain the condition of equilibrium of number of coplanar parallel forces.
3.2.10 Describe an experiment to verify the conditions of equilibrium of parallel coplanar forces.
3.2.11 Solve problems on parallel forces.

Unit No.04 PROPERTIES OF SOLIDS AND LIQUIDS 10 Hrs

GENERAL OBJECTIVES

4.1 To understand the properties of solids.
4.2 To understand the properties of liquids.

SPECIFIC OBJECTIVES

4.1.1 Explain solid as a state of matter.
4.1.2 Explain meaning of “deformation” with examples.
4.1.3 Define elasticity with examples.
4.1.4 Explain the meaning of elastic limit.
4.1.5 Define plasticity with examples.
4.1.6 Define stress.
4.1.7 Write S.I unit and dimensions of stress.
4.1.8 Define Tensile stress with examples.
4.1.9 Define Volume stress with examples.
4.1.10 Define Shear stress with examples.
4.1.11 Define strain.
4.1.12 Define Tensile strain with examples.
4.1.13 Define Volume strain with examples.
4.1.14 Define Shear strain with examples.
4.1.15 State Hooke’s law.
4.1.16 Explain limitations of Hooke’s law.
4.1.17 Draw stress versus strain graph.
4.1.18 Explain the features of the graph.
4.1.19 Define coefficient of elasticity, (Modulus of elasticity)
4.1.20 Write formula of modulus of elasticity.
4.1.21 Define Young’s modulus and write its formula.
4.1.22 Write its S.I unit and dimensions.
4.1.23 Define Bulk modulus and write its formula. Write its SI unit and dimensions.
4.1.24 Define Rigidity modulus and write its formula.
4.1.25 Write its SI unit and dimensions.
4.1.26 Define factor of safety.
4.1.27 Write its formula.
4.1.28 Describe an experiment to determine Young’s modulus of a material using Searle’s apparatus.
4.1.29 Solve problems.
4.2.1 Explain liquid as a state of matter.
4.2.2 Define Thrust and write its S.I unit.
4.2.3 Define pressure and write its S.I unit.
4.2.4 Derive an expression for the pressure at a point inside a liquid at rest.
4.2.5 Solve problems.
4.2.6 Define adhesive forces with example.
4.2.7 Define cohesive forces with an example.
4.2.8 Explain the nature of meniscus with examples.
4.2.9 Define angle of contact with examples.
4.2.10 Explain surface tension on the basis of molecular theory.
4.2.11 Define surface tension.
4.2.12 Write the formula, SI unit and dimensions of it.
4.2.13 Give examples for the existence of surface tension.
4.2.14 Explain the factors affecting the surface tension.
4.2.15 Write the applications of surface tension.
4.2.16 Define capillary rise and capillarity.
4.2.17 Obtain an equation for surface tension in case of capillary rise.
4.2.18 Describe an experiment to determine surface tension of water by capillary rise method.
4.2.19 Solve problems.
4.2.20 Explain the concept of friction in a liquid flow.
4.2.21 Explain viscous force.
4.2.22 Define viscosity.
4.2.23 Explain the factors affecting viscous force.
4.2.24 Define coefficient of viscosity.
4.2.25 Write SI unit and dimensions of coefficient of viscosity.
4.2.26 Discuss the effect of temperature on viscosity of liquids and gases.
4.2.27 List the applications of viscosity.
4.2.28 Describe an experiment to determine viscosity of water by poissulle’s method.

Unit No.05 HEAT AND PROPERTIES OF GASES 05Hrs

GENERAL OBJECTIVES

5.1 To understand Heat and Temperature.
5.2 To study modes and Transmission of heat and their applications.
5.3 To study the specific heat of a substances.
5.4 To study gas laws and specific heat of gas.
5.5 To understand laws of Thermodynamics.

SPECIFIC OBJECTIVES

5.1.1 Define heat.
5.1.2 List the sources of heat.
5.1.3 Define temperature.
5.1.4 Explain different scales of temperature.
5.1.5 Write the differences between heat and temperature.
5.1.6 Define calorie.
5.1.7 Define SI unit of heat - joule.
5.2.1 List the different modes of transmission of heat.
5.2.2 Define conduction.
5.2.3 List the applications of conduction.
5.2.4 Define good conductors of heat and insulators.
5.2.5 List the uses of good conductors and insulators.
5.2.6 Define convection.
5.2.7 Explain two types of convection.
5.2.8 List the applications of convection.
5.2.9 Define radiation.
5.2.10 List the applications of radiation.
5.3.1 Define and explain specific heat of substance.
5.3.2 Obtain the equation for specific heat of substance and write its SI unit.
5.3.3 List the values for specific heats of few materials commonly used.
5.3.4 Solve simple numerical problems on equation for specific heat.
5.4.1 State Boyle’s law.
5.4.2 Write the expressions of Boyle’s law.
5.4.3 State Charle’s law and write its mathematical expression.
5.4.4 State Gay-Lussac’s law and write its mathematical expression.
5.4.5 Explain the Absolute scale of temperature on the basis of Charle’s law, give its graphical representation.
5.4.6 Obtain combined gas equation and perfect gas equation.
5.4.7 Solve problems
5.4.8 Define specific heat of a gas at constant volume (Cv).
5.4.9 Define specific heat of a gas at constant pressure (Cp).
5.4.10 Write the relation between Cp and Cv (i) ratio of specific heat. (ii) Meyer’s relation (no derivation.)
5.5.1 Define Isothermal process and Adiabatic process with reference to gas.
5.5.2 State First law of thermodynamics.
5.5.3 Write the mathematical expression of First law of thermodynamics.
5.5.4 State the Second law of thermodynamics.
5.5.5 List the application of Second law of thermodynamics.

Unit No.06 WAVE MOTION 12 Hrs

GENERAL OBJECTIVES

6.1 To understand Simple Hormonic Motion.
6.2 To understand wave motion.
6.3 To understand stationary waves, resonance and beats.
6.4 To study transverse vibrations of stretched strings.
6.5 To know musical note and noise.
6.6 To study acoustics of buildings.

SPECIFIC OBJECTIVES

6.1.1 Define vibratory motion with examples.
6.1.2 Define periodic motion with examples.
6.1.3 Explain and define Simple Hormonic Motion.
6.1.4 Obtain an expression for displacement, velocity and acceleration or a particle executing SHM
6.1.5 Define period, frequency, amplitude in the case of vibrating particle.
6.2.1 Explain wave and wave motion with example.
6.2.2 Explain mechanical waves and electromagnetic waves with examples.
6.2.3 Define transverse waves with example.
6.2.4 Define longitudinal waves with example.
6.2.5 List the differences between transverse waves and longitudinal waves.
6.2.6 Define wave frequency, wave period, wave length, wave velocity, wave amplitude for a wave.
6.2.7 Derive the relation \( V = n\lambda \).
6.2.8 Solve problems on the relation.
6.2.9 Explain propagation of sound in air.
6.2.10 Explain Newton’s assumptions for the velocity of sound in air (gas) and write formula.
6.2.11 Explain Laplace’s assumption for velocity of sound in air.
6.2.12 Write Newton - Laplace formula for the velocity of sound in a gas.
6.2.13 Discuss the effect of pressure, temperature, humidity on the velocity of sound.
6.2.14 Solve problems on Newton - Laplace formula.
6.3.1 Define stationary waves.
6.3.2 List the characteristics of stationary waves.
6.3.3 Define free vibrations with examples.
6.3.4 Define forced vibrations with examples.
6.3.5 Define resonance with examples.
6.3.6 Describe an experiment to determine the velocity of sound in air at room temperature and zero degree celsius by resonance air column method.
6.3.7 Solve problems.
6.3.8 Define beats, beat frequency.
6.3.9 State applications of beats. Solve problems.
6.4.1 Explain the transverse vibrations of stretched strings.
6.4.2 State the three laws of transverse vibration of stretched strings with relevant formula.
6.4.3 Describe an experiment to determine the frequency of tuning fork by comparison method using sonometer.
6.4.4 Describe an experiment to determine the frequency of tuning fork by absolute method using sonometer.
6.4.5 Solve problems.
6.5.1 Define musical note, noise.
6.5.2 List the differences between musical note and noise.
6.5.3 List the characteristics of musical note.
6.6.1 Explain acoustics with regards to buildings.
6.6.2 List the different types of defects of acoustics in buildings.
6.6.3 Define Echo, Reverberation, Intereference, Resonance.
6.6.4 Define Reverberation time.
6.6.5 Define absorptive coefficients of materials.
6.6.6 Write Sabine’s formula and explain the notations.
6.6.7 List the different remedies for defects.
6.6.8 Solve problems on Sabine’s formula.

Unit No.07  PHYSICAL OPTICS  12Hrs

GENERAL OBJECTIVES

7.1 To understand various theories of light.
7.2 To understand the concept of Interference.
7.3 To understand the concept of Diffraction.
7.4 To understand the concept of Polarisation.
### SPECIFIC OBJECTIVES

#### 7.1.1 Explain Newton’s corpuscular theory.

#### 7.1.2 Explain Huygen’s wave theory.

#### 7.1.3 Explain Maxwell’s Electromagnetic theory.

#### 7.1.4 Explain Planck’s quantum theory.

#### 7.1.5 Explain dual nature of radiation (light).

#### 7.2.1 Define interference.

#### 7.2.2 Obtain the equation for resultant displacement.

#### 7.2.3 Derive the equation for amplitude of the resultant wave.

#### 7.2.4 Discuss the conditions for constructive interference.

#### 7.2.5 Discuss the conditions for destructive interference.

#### 7.2.6 List the conditions of sustained interference.

#### 7.2.7 Explain Young’s double slit experiment.

#### 7.2.8 Obtain expression for path difference.

#### 7.2.9 Obtain expression for fringe width.

#### 7.2.10 Explain the intensity distribution in interference fringe.

#### 7.2.11 Solve simple problems on fringewidth and path difference.

#### 7.3.1 Define diffraction.

#### 7.3.2 Define Fresnel diffraction and Fraunhoffer diffraction.

#### 7.3.3 Differentiate Fresnel diffraction and Fraunhoffer diffraction.

#### 7.3.4 Explain Huygen’s principle related to wavefront.

#### 7.3.5 Explain diffraction with white light.

#### 7.3.6 Differentiate between interference and diffraction.

#### 7.3.7 Explain the concept of resolving power of an optical instrument.

#### 7.3.8 Explain Rayleigh’s criteria on resolving power.

#### 7.3.9 Define limit of resolution and resolving power of a microscope in terms of wave length.

#### 7.3.10 Define resolving power of a Telescope.

#### 7.3.11 Write the formula for resolving power of Telescope in terms of wavelength.

#### 7.3.12 Solve simple problems.

#### 7.4.1 Define Polarisation.

#### 7.4.2 Describe an experiment to demonstrate the transverse nature of light.

#### 7.4.3 Represent unpolarised and polarized light geometrically.

#### 7.4.4 Define plane of vibration.

#### 7.4.5 Define plane of polarization.

#### 7.4.6 Explain the method of polarization by reflection.

#### 7.4.7 State Brewster’s law. Define Brewster’s angle.

#### 7.4.8 Obtain equation for refractive index in terms of Brewster’s angle.

#### 7.4.9 Explain the method of polarization by refraction.

#### 7.4.10 Explain the method of polarization by double refraction.

#### 7.4.11 Explain polaroids.

#### 7.4.12 List the use of polaroids.
GENERAL OBJECTIVES

8.1 To understand the emission of electrons.
8.2 To know the scattering of light.
8.3 To understand Lasers.
8.4 To understand radio-activity.

SPECIFIC OBJECTIVES

8.1.1 Explain thermionic emission.
8.1.2 Explain photoelectric emission.
8.1.3 Explain Field emission.
8.1.4 Explain secondary emission.
8.1.5 Define photoelectric effect.
8.1.6 Describe an experiment to study photoelectric effect. Explain experimental results.
8.1.7 State four laws of photoelectric emission.
8.1.8 Write photoelectric equation.
8.1.9 Explain the quantities involved in it.
8.1.10 Explain photoemissive cell.
8.1.11 Explain photovoltaic cell.
8.1.12 Explain photoconductive cell.
8.1.13 List the applications of photoelectric cells.
8.1.14 Explain the principle of electrons microscope.
8.1.15 Explain the method of focusing by magnetic lens.
8.1.16 Explain the construction and working.
8.1.17 List the uses of electron microscope.
8.1.18 Explain the working of Atomic Focus Microscope.
8.1.19 Write the advantages of Atomic Focus Microscope.
8.2.1 Explain coherent scattering.
8.2.2 Explain incoherent scattering.
8.2.3 Explain the blue colour of the sky and blue colour of water.
8.2.4 Explain the red colour of sun during sunrise and sunset.
8.2.5 Explain the white colour of cloud.
8.2.6 Explain Raman Effect.
8.2.7 Write the applications of Raman Effect.
8.3.1 Define laser.
8.3.2 Explain Induced absorption.
8.3.3 Explain spontaneous emission and stimulated emission.
8.3.4 State the principle of Laser.
8.3.5 Explain population inversion and optical pumping.
8.3.6 List the properties of laser.
8.3.7 Write the applications of laser.
8.4.1 Explain radioactivity with examples.
8.4.2 Describe an experiment to demonstrate three types of radiations.
8.4.3 Write the properties of alpha, beta and gamma rays.
8.4.4 List the agricultural, medical, biological and geological applications of lasers.
GENERAL OBJECTIVES

9.1 To understand pollution, its harmful effects and preventive measures.
9.2 To comprehend water pollution, its harmful effects and preventive measures.
9.3 To understand different types of corrosion and preventive measures.
9.4 To comprehend pH of solution, pH scale and applications of pH.

SPECIFIC OBJECTIVES

9.1.1 Define pollution.
9.1.2 List air pollutants.
9.1.3 Write the harmful effects of air pollution.
9.1.4 Explain acid rain and its effects.
9.1.5 Explain green house effect.
9.1.6 Explain global warming.
9.1.7 List the effects of global warming.
9.1.8 Explain ozone layer and its importance.
9.1.9 List the cause of depletion of ozone layer (without any equation).
9.1.10 List the effects of ozone layer.
9.1.11 Discuss the control of air pollution.
9.2.1 Explain water pollution,
9.2.2 Discuss the causes of water pollution (sewage, effluents, algae, micro-organisms).
9.2.3 Explain methods of control of sewage problems and disposals.
9.3.1 Define corrosion.
9.3.2 Explain the causes of corrosion.
9.3.3 Describe different types of corrosion. (i) electrochemical theory of corrosion. (ii) Formation of galvanic cells. (iii) concentration cells
9.3.4 Explain the preventive measures of corrosion.
  i. by alloying  ii. by surface coating  iii. by galvanizing  iv. by electroplating  v. by anodizing  vi. by cathodic protection.
9.4.1 Explain water as a weak electrolyte.
9.4.2 Explain nature of solution on the basis of (H+) ion and (OH−) ion concentrations.
9.4.3 Explain ionic product of pure water.
9.4.4 Define neutral, basic and acidic solutions.
9.4.5 Define pH of a solution.
9.4.6 Define neutral basic and acidic solution by using pH.
9.4.7 Give the pH values some solutions
9.4.8 Write the applications of pH solution.

REFERENCE BOOKS

1. Applied Science – By W.R. Neelakanta, Sapna Publications
2. Applied Science – By N N Banavasi, S Chand Publications
3. First PUC and Second PUC Physics Text Books – by different authors.
5. Essentials of physical chemistry by B.S.Bhal and G.B.Tuli,
7. Applied Science for polytechnics- by different authors.

APPLIED SCIENCE

TABLE OF SPECIFICATION FOR QUESTION PAPER SETTING

<table>
<thead>
<tr>
<th>Unit No</th>
<th>No Hrs in curriculum</th>
<th>No of subdivisions of 5 marks each to be answered</th>
<th>Total marks to be answered</th>
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BOARD OF TECHNICAL EXAMINATION- KARNATAKA

MODEL QUESTION PAPER

APPLIED SCIENCE

Time:3Hrs Max Marks:100

Note: 1) Answer any 05 subdivisions from Section A, any 07 sub divisions from Section B and any 08 subdivisions from Section C
2) Each subdivision carries 5 marks.

Section A (Answer any 05 subdivisions)

1. a) What is meant by Least count of a measuring instrument
   Write dimensions of density
   Write the S.I. unit of a acceleration
   \[ 2 + 2 + 1 \]

b) State and prove the law of conservation of momentum
   \[ 2 + 3 \]

c) State Newton’s Second law of motion.
A body of mass 2kg is moving with a velocity of 2m/s. If its velocity changes to 5m/s in 10 seconds on application of a constant force, calculate the acceleration of the body & Impulse on it.  

2. a) Write a neat diagram of screw gauge & name its parts  
   b) State the law of parallelogram of vectors.  
      Obtain an expression for the magnitude of the resultant of two Vectors acting at a point.  

3. a) Describe an experiment to verify Lami’s theorem  
   b) Define Moment of a force.  
      Three forces 3kgwt, 7kgwt & 15kgwt, acting at a point are in equilibrium.  
      Calculate the angle between first two forces.  

Section B  (Answer any 07 subdivisions)

4. a) Define stress.  
      Differentiate between plasticity and elasticity with examples.  
   b) Define Young’s Modulus  
      Write 3 applications of capillarity  
   c) Describe an experiment to determine surface tension of water by capillary rise method  

5. a) Distinguish between specific heat of a substance & heat capacity of a body.  
      Write two applications of convection.  
   b) Define surface tension and angle of contact.  
      Write 3 applications of viscosity.  
   c) Derive PV = mRT with usual notations  

6. a) Define SHM  
      Obtain an expression for the velocity of a vibrating body executing SHM  
   b) Describe an experiment to determine velocity of sound in air at room temperature, using Resonance Air Column apparatus.  
   c) What is resonance?  
      Write 3 practical examples of resonance.  

7. a) Describe an experiment to determine the frequency of the tuning fork using sonometer by comparison method.  
   b) The frequency of a sonometer wire is doubled when the tension is increased by 12 kgwt. Calculate the original tension of the wire.
Section C  (Answer any 08 subdivisions)

8. a) What is interference of light?
   Write three differences between Interference & diffraction.  
   b) Obtain an expression for the path difference in Young’s double slit experiment. 
   c) In a double slit experiment light of wave length 5500 Å is used. Find the path difference & phase difference for the fourth dark fringe from the centre of the pattern.  

9. a) State Brewster’s law.
   Obtain an expression for the refractive index of a material in terms of Brewster’s angle. 
   b) What is polarization?
   Explain the method of polarization by refraction 
   c) What is photoelectric emission?
   Write any three experimental results on the study of photoelectric effect. 

10. a) Explain the focusing the magnetic lens in an Electron microscope
    Write 3 uses of Electron microscope. 
    b) What is Raman effect.
    Explain stimulated emission in Laser. 
    c) What is radio activity?
    Describe an experiment to demonstrate 3 types of radiations. 

11. a) What is an acid rain? Write 3 harmful effects of it. 
    b) What are the causes of water pollution?
    Explain any one method of controlling sewage problem. 
    c) How does a “Concentration cell” work?
    Write three applications of PH.
GOVERNMENT OF KARNATAKA
BOARD OF TECHNICAL EXAMINATIONS
First/Second Semester Diploma
APPLIED SCIENCE LAB (COMMON TO ALL COURSES)  SUBJECT CODE:

<table>
<thead>
<tr>
<th>Group A</th>
<th>Experiment No</th>
<th>Aim of the experiment</th>
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<tbody>
<tr>
<td>01</td>
<td>To determine the volume of the given solid cylinder using <strong>Slide calipers</strong></td>
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<tr>
<td>02</td>
<td>To determine the volume of the given hollow cylinder using <strong>Slide calipers</strong></td>
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</tr>
<tr>
<td>03</td>
<td>To determine the thickness of the glass and metal plate using <strong>Screw gauge</strong></td>
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<tr>
<td>04</td>
<td>To determine the volume of thin wire using <strong>Screw gauge</strong> &amp; sample wire</td>
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<tr>
<td>05</td>
<td>To determine the volume of small rigid ball using <strong>Screw gauge</strong></td>
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<tr>
<td>06</td>
<td>To verify the law of Parallelogram of vectors</td>
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<td>07</td>
<td>To verify the converse of law of triangle of vectors</td>
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<tr>
<td>08</td>
<td>To verify <strong>two</strong> conditions of equilibrium of coplanar parallel forces</td>
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<table>
<thead>
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<th>Group B</th>
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<tbody>
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<td>15</td>
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</table>

**Most Important instructions to examiners**

i) While setting two experiments in the examination for each candidate, one experiment should be chosen from **group A** and another must be from **group B**

ii) While setting two experiments, large number of **combinations** to be made covering most of the experiments

iii) The scheme of valuation given below must be strictly followed.

**Scheme of valuation**

<table>
<thead>
<tr>
<th>Record</th>
<th>05 Marks</th>
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<tr>
<td>Oral</td>
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<tr>
<td>Planning (Includes observation, Tabular column, Formula)</td>
<td>20 Marks (10 marks x 2 expt)</td>
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<tr>
<td>Conducting (Includes skill in arrangement, handling of app,</td>
<td>40 Marks (20 marks x 2 expt)</td>
</tr>
<tr>
<td>Calculation and result</td>
<td>20 Marks (10 marks x 2 expt)</td>
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<td>------------------------</td>
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<td><strong>Total</strong></td>
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## Course Content

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<th>Course Description</th>
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<tr>
<td>1 Concept of Hardware &amp; Software</td>
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</tr>
<tr>
<td>2 Word processing (M S Word)</td>
<td>18</td>
</tr>
<tr>
<td>3 Spreadsheet and Charts (M S Excel)</td>
<td>18</td>
</tr>
<tr>
<td>4 Dataprocessing (M S Access)</td>
<td>10</td>
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<tr>
<td>5 Presentation (M S Power Point)</td>
<td>08</td>
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<tr>
<td>6 Internet Basics</td>
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<tr>
<td><strong>Total</strong></td>
<td><strong>64</strong></td>
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</table>

## Reference Books

1. Basic Computer Skills By Dr. M A Jayaram & D S Rajendra Prasad, Sapna Publishers
   
2. A Computer Laboratory referral for Diploma & Engineering students
   BY: T R Jagadish et.al- Universities Press
Diploma Course in Mechanical Engineering (Welding & Sheet Metal Engg)
I Semester
Subject: Basic Computer Skills
Contact hrs/Week: 04
Total Contact Hrs / Sem.: 64

General Educational Objectives:

After the completion of the study of this subject students should be able to
1. Recognize the various models of computer system
2. Recognize the various parts, physical components of a computer
3. Understand the cable connections and booting steps
4. Know the various I/O devices
5. Understand the need of Operating System
6. Use the various DOS commands
7. Understand the use of mouse buttons
8. Appreciate working under windows environment
9. Appreciate the use of Windows Explorer
10. Create any document
11. Know to format the document and take a printout
12. Create a worksheet in
13. Use functions and formulas
14. Know to format the worksheet and take a printout
15. Create a database
16. Create view, form, table, query and report
17. Know to take the printout of the report
18. Create a presentation using Powerpoint
19. Know to insert Slides into the presentation
20. Understand various slide transitions
21. Demonstrate the slide show
22. Know to print the handouts
23. Understand the basics of Internet
24. Create an e-mail account
25. Know to send and receive mails
26. Use search engine while browsing
27. Use any Kannada Software package

Specific Instructional Objectives:

1 Concepts of Hardware and Software
   1.1 Identify the models of computers - Tower, Desktop, Laptop, Palmtop
   1.2 Identify and understand front panel switches and back panel connectors of a computer system.
   1.3 Identify and understand the physical components of computer:
      1.3.1 Motherboard (System Board)
      1.3.2 Processor chip
      1.3.3 Memory
      1.3.4 HDD
      1.3.5 FDD
      1.3.6 CDD(R/W)
      1.3.7 SMPS
      1.3.8 Ports (Serial, Parallel & USB)
      1.3.9 VGA/SVGA/AGP
      1.3.10 Sound card
      1.3.11 Network Card
      1.3.12 MODEM Card (internal and External)
1.3.13 Input devices - Keyboard, Mouse, Scanner, Joystick, Floppy, Compact Disk, etc.
1.3.14 Output devices - Monitor, Printer, Plotter, etc.
1.4 Understand the need of an Operating system
1.5 Differences between command line and graphical user interface
1.6 Understand the meaning of the following terms:
   1.6.1 Single user single tasking
   1.6.2 Single user multi tasking
   1.6.3 Multi user multi tasking
   1.6.4 Batch processing
   1.6.5 Real time Processing
   1.6.6 Distributed processing
1.7 Do the connections of the system, switch on and understand the booting steps
1.8 Understand the concept of file and directory, naming rules for files / directories, types of files
1.9 Basic DOS commands - CLS, DIR, Date, Time, Version, MD, CD, RD, Del, Copy, Ren, Volume; Use of wild characters, Format, Path, Type
1.10 Getting started with
   1.10.1 Windows
   1.10.2 Desktop
   1.10.3 Icons
   1.10.4 Mouse operations - single click, double click, click & drag
   1.10.5 Shortcuts
   1.10.6 Popup Menus
   1.10.7 Start button
   1.10.8 Keyboard operations in window
   1.10.9 Task Bar
   1.10.10 Customizing the desktop
1.11 Exposure to Windows Operating System
   1.11.1 Logging on to Windows
   1.11.2 Starting and closing a program
   1.11.3 Switching between programs, documents
   1.11.4 Re-sizing windows - Maximize, Minimize and restore
   1.11.5 Find - file, folders, etc.
   1.11.6 Run - starting a program using run command
   1.11.7 Shutdown - shutdown / restart computer
1.12 Practice Windows Explorer - through My computer, Icon and shortcut entry
1.13 Creating/opening a document
1.14 Understand clipboard concept for copy, cut and paste
1.15 Editing and saving the document in Floppy/ Hard disk
1.16 Study and understand Windows utilities - notepad, wordpad, paint, calculator, etc
1.17 Study and understand Windows system tools - scandisk, backup, system info, winzip, etc
2 Utilities

2.1 WORD PROCESSING
2.1.1 Invoking word application and understand the different parts - titlebar, Menubar, Toolbar, Scrollbar, Control button, etc
2.1.2 Create a new document - edit, save, close
2.1.3 Page setup (Layout)
2.1.4 Text formatting - Selection of Fonts, fontsize, alignments, line spacing, paragraph alignment, indents & tabs
2.1.5 Creating documents with Multiple columns
2.1.6 Inserting symbols, file, hyperlink, cliparts and pictures into the document
2.1.7 Page formatting - Inserting page numbers, date, time, fields, header and footer, footnote, comments, etc
2.1.8 Practicing the utilities like find, replace, goto, spell check, grammar check, thesaurus, wordcount, autotext and autocorrect
2.1.9 Creating drawings and charts using drawing toolbar
2.1.10 Creating tables and borders
2.1.11 Creating templates, envelopes & labels
2.1.12 Object Linking and Embedding (OLE)
2.1.13 Taking printout of the document
2.1.14 Mail-merging
2.1.15 Creating Macros and customizing Word
2.1.16 Exiting Word

2.2 SPREADSHEET AND CHARTS
2.2.1 Invoking Excel application and understand the different parts - titlebar, Menubar, Toolbar, Scrollbar, control window, etc
2.2.2 Creating an excel book
2.2.3 Understanding the excel sheet, cell, rows & columns, sheet size, navigating the workbook
2.2.4 Entering data - numeric, text and formula
2.2.5 Formatting a cell - number, date, time, text, alignment, border, font, pattern, protection, etc.
2.2.6 Formatting rows and columns
2.2.7 Understand Filling series
2.2.8 Selecting cells, rows or columns
2.2.9 Clearing contents and formats of the cells selected
2.2.10 Creating different types of graphs for given data
2.2.11 Formatting charts
2.2.12 Dealing with formulas, functions related with text, logical, mathematical, etc
2.2.13 Manipulating Data - Sorting, filtering, validation, importing & exporting data
2.2.14 Working with windows - Splitting, freezing and setting the print area
2.2.15 Creating an excel report
2.2.16 Printing an excel sheet/part of an excel sheet
2.2.17 Object Linking and Embedding (OLE)
2.2.18 Creating Macros and customizing Excel
2.2.19 Exiting Excel

2.3 DATAPROCESSING
2.3.1 Starting Access and understanding the concept of data, field, record, table and database
2.3.2 Creating a database, tables, view, forms, query, report, index, etc
2.3.3 Use of wizards to create tables
2.3.4 Create a report and take the printout
2.3.5 Creating Macros and customizing Access
2.3.6 Exiting Access

2.4 PRESENTATION
2.4.1 Invoking Powerpoint application and understand - titlebar, Menubar, Toolbar, Scrollbar, control window, etc
2.4.2 Creating a presentation using auto context wizard, Design Templates and Blank presentation
2.4.3 Opening, saving, closing a presentation
2.4.4 Working with slides - Inserting pictures, tables, sound files, outline, slide transitions
2.4.5 Slide show - manual, auto
2.4.6 Printing handouts
2.4.7 Creating Macros and customizing PowerPoint
2.4.8 Exiting PowerPoint

3 INTERNET
3.1 Understand the meaning of:
   Network, Internet, intranet, internet server, internet browser, Webpage, Website, URL's,
   Search engines, http, www, HTML, DHTML, and Outlook
3.2 Logging on to internet, browsing the net, using search engines, Downloading a file
3.3 Creating an E-Mail ID, Sending and Receiving E-Mails, voicemail, video mail, video
   conferencing, etc
3.4 Chatting

4 Practice on any Kannada Software Package

SAMPLE EXERCISES

WORD PROCESSING
1. Create a business or personal letter
2. Create a company letterhead
3. Create a simple newsletter
4. Create a memo
5. Create a resume
6. Create an Invitation/Greeting Card
7. Create the cover page of a project report
8. Create a mailmerged letter/Invitation
9. Create a Macro which inserts a picture and formats the text

SPREADSHEET
1. Create a worksheet with 4 columns. Enter 10 records and find the sum of all columns
2. Create a report containing the pay details of the employees
3. Create a results sheet containing Candidate's Register No., Name, Marks for all subjects, Total and result.
   Total and result must be calculated as below:
   Total is sum of marks in all subjects
   Result is Distinction if Total >= 70 %
   First Class if Total >= 60 % and < 70 %
   Second Class if Total >= 50 % and < 60 %
   Pass if Total >= 35 % and < 50 %
   provided the candidate has secured atleast 35 marks in each subject. Fail otherwise.
4. Create a simple Bar chart to highlight the sales of a company for 3 different periods
5. Create a pie-chart - give legends
6. Create a worksheet importing data from a database and calculate sum of all the columns
7. Create a Macro which creates a line chart using the data in the worksheet

DATABASE
1. Create a simple table for result processing
2. Design a query table for the same table
3. Design a form to update/modify the table contents
4. Design a report to print the result sheet and marks card for the above table.

PRESENTATION
1. Create a simple presentation to list simple DOS commands, Hardwares, Softwares etc.

INTERNET BASICS
1. Practice browsing of different sites using search engine
2. Practice understanding different e-mail services - Outlook, Yahoomail, rediffmail etc.
3. Practice creating e-mail account, Sending Receiving & Storing of mails

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<tr>
<th>Scheme of Examination</th>
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<tbody>
<tr>
<td><strong>Duration:</strong> 3 Hrs</td>
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<tr>
<td>1 Record</td>
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<tr>
<td>2 Viva</td>
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<tr>
<td>3 One question each on any two of the following</td>
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<tr>
<td>3.1 M S Word</td>
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<tr>
<td>3.2 M S Excel</td>
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<td>4 Internet Basics</td>
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<tbody>
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<tr>
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<tr>
<td>3 One question to be set from any 2 of the 4 combination</td>
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<tr>
<td>3.1 Writing</td>
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<td>3.2 Execution</td>
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<td>3.3 Printout</td>
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<tr>
<td>4 Two or Three Questions to be asked on Internet Basics</td>
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Diploma Course in Mechanical Engineering (Welding & Sheet Metal Engg)
First Semester
Subject Title: Engineering Graphics

Contact hrs/week : 6 Hrs
(2 Slots of 3 Hrs each/Week)

Contact hrs. / Sem: 96

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<th>Sl. No.</th>
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<td>Introduction to Engineering Graphics</td>
<td>9</td>
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<tr>
<td>2</td>
<td>Dimensioning</td>
<td>12</td>
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<tr>
<td>3</td>
<td>Projection of Points</td>
<td>9</td>
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<td>Projection of Lines</td>
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<td>Projection of Planes</td>
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<td>7</td>
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Subject Contents

1 Introduction to Engineering Graphics
Definition of the drawing-technical drawing
Engineering Instruments
Drawing Board, sheet - their standards sizes
Title Block, layout, Symbols,
types of lines, conventions, standards
applications of different types of lines

2 Dimensioning
Definition and importance
Dimensioning components:
Dimension line, extension line, arrow head, leader, dimensional figure, symbol, scale or
Systems of dimensioning
aligned system
unidirectional system
Arrangement of dimensioning
chain, parallel, progressive, combined, co-ordinate, equal and equi-distant...
Dimensioning common features
Circular, fillets, chamfers, rounds, curved surface, spherical, angles, tapers, threads, ar

3 Projection of Points
Four quadrants, principal planes, profile planes
Projection of points in all the four quadrants
Projection of points- front view, top view and side views

4 Projection of lines
Projection of line when parallel to both the planes
Projection of line parallel to one plane and perpendicular to other plane
Projection of line inclined to one plane and parallel to other plane
(Side views for above cases)
Projection of line inclined to the both the planes
5 Projection of planes
Meaning of the planes like square, rectangular, pentagonal, hexagonal, and circular.
Drawing the three views of the planes in different positions using first angle projection method.
Solving the problems using change of position method only.

6 Projection of solids
(All problems should be taught considering solids should be resting on HP)
Projection of cube, triangular prism, square prism, rectangular prism, pentagonal prism, hexagonal prism, pyramids like square, rectangular, pentagonal and hexagonal, Cone and cylinder in different positions using first angle projection method.

7 Projection of Isometric View to orthographic views
Projection of orthographic views of solids like prism, pyramid, cube, cylinder, cone, Sphere, machine components etc.

Tests

Scheme of Examination
1 Chapter 1 is only for practice and internal assessment and not for examination.
2 Three questions must be set as per the following pattern.

<table>
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Question paper can be set as per regular M08 standards.

Reference books
1 Elementary engineering drawing: N.D. Bhatt
2 Engineering Drawing: K.R. Gopal Krishna
3 Fundamentals of engineering drawing: R.K. Dhawan
6 Engineering Drawing: I.S. Morries
7 Step by step engineering drawing: Vee Ess
8 Engineering graphics: Verges
9 Engineering drawing by Venugopal
nd units

nd knurls

9

12

id units

rd knurls

9

15
# BOARD OF TECHNICAL EXAMINATION – KARNATAKA

## SUBJECT: APPLIED MATHEMATICS – I

For I- semester

**DIPLOMA COURSES OF ALL BRANCHES**

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<tr>
<th>UNIT NO.</th>
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**REFERENCE BOOKS:**
1. Applied Mathematics -I By W.R Neelakanta Sapna Publications.
2. Applied Mathematics -I By Dr. D S Prakash S Chand Publications
3. Text book of mathematics for P U C
**QUESTION PAPER BLUE PRINT**  
**FOR APPLIED MATHEMATICS – I**

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CONTENTS OF APPLIED MATHEMATICS – I

ALGEBRA

UNIT – 1: DETERMINANTS. 2 Hr.

Definition, Order, Expansion of 2\textsuperscript{nd} & 3\textsuperscript{rd} order Determinants by means of examples. Problems on finding unknown quantity in a 2\textsuperscript{nd} & 3\textsuperscript{rd} determinant using using expansion. Solving simultaneous linear equations by determinant method (Cramer’s rule). Problems.

UNIT – 2: MATRICES. 4 Hr.


UNIT – 3: BINOMIAL THEOREM. 3 Hr.

Meaning of \(^n\text{C}_r\) and its value. Binomial theorem for \((x + a)^n\), where \(n\) ia a positive integer. Expansion. Finding constant term, co-efficient of \(x^n\), particular term and middle term(s). Problems.

UNIT – 4: LOGARITHMS. 2 Hr.


UNIT – 5: VECTOR ALGEBRA. 6 Hr.

TRIGONOMETRY

UNIT – 6: UNITS AND MEASUREMENT OF AN ANGLE 3 Hr

Defination of an angle. Systems of unit of an angle. Defination of radian. Radian is a constant angle. Relation between degree & radian and problems. Derivation of \( l = r\theta \) & \( A = \frac{1}{2} r^2\theta \). Problems.

UNIT –7: TRIGONOMETRIC RATIOS OF AN ACUTE ANGLE. 6 Hr

Defination of Trigonometric ratios in terms of sides of a triangle for an acute angle. Proof of Trigonometric identities. Trigonometric ratios of standard angles: The numerical value of trigonometric ratios of standard angles like \( 0^\circ, 30^\circ, 45^\circ, 60^\circ \) and \( 90^\circ \). Problems.

UNIT – 8: ALLIED ANGLES. 4 Hr.


UNIT – 9: HEIGHTS AND DISTANCES. 2 Hr.

Defination of angle of elevation and depression. Problems.

UNIT -10: COMPOUND ANGLES. 3 Hr.

Geometrical proof of Sin( \( A + B \)) and Cos(\( A + B \)). Find Tan( \( A + B \)) using Sin( \( A + B \)) and Cos(\( A + B \)). Write the formulae for Sin( \( A - B \)), Cos(\( A - B \)) and tan( \( A - B \)). Problems.

UNIT -11: MULTIPLE ANGLES. 3 Hr.


UNIT-12: TRANSFORMATION FORMULAE. 4 Hr.

Express sum or difference of Sine and Cosine of an angles in to product form. Express product of Sine and Cosine of angles in to sum or difference form. Problems.
UNIT-13: PROPERTIES AND SOLUTION OF TRIANGLES.  

The relation between sides of a triangle and Sines, Cosines and Tangents of any angle(Sine rule, Cosine rule and Tangent rule), Projection rule. Half angle formulae in terms of sides of a triangle. Problems. Problems on solution of triangles (four types).

UNIT-14: INVERSE TRIGONOMETRIC FUNCTIONS.  

Definition. Principle values of inverse trigonometric functions. Derivation of results like \( \sin^{-1}x + \cos^{-1}x = \frac{\pi}{2} = \tan^{-1}x + \cot^{-1}x = \cosec^{-1}x + \sec^{-1}x, \tan^{-1}x + \tan^{-1}y = \tan^{-1} \)

Problems.

ANALYTICAL GEOMETRY

UNIT-15: BASIC CONCEPTS OF ANALYTICAL GEOMETRY.  

Definition of a point in a plane, Specification of a point using co-ordinate system. Points on X-axis and Y-axis. Derivation of distance formula. Problems. Section formulae. Derivation of co-ordinate of a point which divide the line internally in the given ratio( No derivation for external division). Mid point formula. Problems. Centroid, area of a triangle and collinear points. Problems. Locus of a point with respect to a fixed point and with respect to two fixed points and its equations. Problems.

UNIT-16: STRAIGHT LINES.  

Inclination of a line with horizontal line and its slope. Intercept of a straight line. Slope of a line parallel to X-axis and Y-axis. Derivation of conditions for two lines to be parallel and perpendicular. Problems. Derivations equations of straight lines \( y = mx + c, \ y - y_1 = m (x - x_1 ), \ y - y_1 = (y_2 - y_1 / x_2 - x_1 ) (x - x_1 ), \) \( (x / a ) + (y / b) = 1 \) and \( x \cos \alpha + y \sin \alpha = P. \) General equation of a line \( ax + by + c = 0 \) and problems. Equation of lines through a point and parallel or perpendicular to a given line. Problems. Angle between two lines. Problems. Point of intersection of lines. Equation of a line through the point of intersection which is parallel or perpendicular to the given line. Problems.

**********************************
GENERAL AND SPECIFIC OBJECTIVES

ALGEBRA

UNIT – 1: DETERMINANTS. 2 Hr

GENERAL OBJECTIVES.

1.1 To understand meaning of determinants and evaluation of 2nd & 3rd order determinants.
1.2 To understand the solution of linear equations by Cramer’s rule.

SPECIFIC OBJECTIVES.

1.1.1 Definition of Determinant by means of Algebraic Expression and order in terms of Rows and Columns.
1.1.2 Evaluate Determinants of 2nd & 3rd order --- Problems.
1.1.3 Solve the problems to find unknown quantity in a determinant.
1.2.1 Solve the linear equations of 2nd or 3rd unknowns using determinants. Problems

UNIT – 2: MATRICES. 4 Hr

GENERAL OBJECTIVES.

2.1 To understand Minors and co-cofactors, adjoint and inverse of a matrix.
2.2 To know the characteristic equation for 2 x 2 matrix.

SPECIFIC OBJECTIVES.

2.1.1 Define singular and non singular square matrix.
2.1.2 Find the minors and cofactors of each elements of matrix
2.1.3 Define adjoint of a square matrix.--- Problems.
2.1.4 Define inverse of a square matrix --- Problems.
2.2.1 Explain characteristic equation of a 2 x 2 matrix and its roots --- Problems.
2.2.2 State Cayley – Hamilton’s theorem for 2nd order (Statement only) --- Problems.
2.2.3 Apply it to find inverse of the matrix --- Problems.

UNIT – 3: BINOMIAL THEOREM. 3 Hr

GENERAL OBJECTIVES.
3.1 To recognise the meaning of \( ^nC_r \) & to compute the values \( ^nC_0, ^nC_1, ^nC_2 \ldots \) \( ^nC_r \)
3.2 To prove \( ^nC_r = ^nC_{n-r} \) by demonstration.
3.3 To know the statement of \((x+a)^n\) for positive integral Index n.

SPECIFIC OBJECTIVES.

3.1.1 Meaning of \( ^nC_r \) and value of \( ^nC_r \).
3.2.1 Use of \( ^nC_r \) in the expansion \((x+a)^n\), where n is positive integer.
3.3.1 Expansion of \((x+a)^n\), where n is positive integer. (only statement).
3.3.2 Solve the problems of the following types
   (a) expansion of type \((2x+y)^6\), \((\sqrt{3} + 2)^4\), \((x^2 - 1/\sqrt{x})^8\)
   (b) To simplify \((\sqrt{2} + 1)^5 + (\sqrt{2} - 1)^5\)
   (c) To find middle term(s)
   (d) To find the coefficient of \(x^n\) and constant terms in \((x+a)^n\)

UNIT – 4: LOGARITHMS

GENERAL OBJECTIVES.

4.1 To understand logarithm, common logarithm and natural logarithm.
4.2 To comprehend laws of logarithm.

SPECIFIC OBJECTIVES.

4.1.1 Define logarithm, common logarithm and natural logarithm.
4.2.1 Derive the laws of logarithm
   (a) \( \log_a mn = \log_a m + \log_a n \)
   (b) \( \log_a m/n = \log_a m - \log_a n \)
   (c) \( \log_a x^k = k \log_a x \)
   (d) \( \log_a b = \log_c b / \log_c a \) (CHANGE OF BASE)
4.2.2 Solve problems on laws of logarithms

UNIT – 5: VECTOR ALGEBRA

GENERAL OBJECTIVES.

5.1 To understand vectors.
5.2 To understand vector operations.

SPECIFIC OBJECTIVES.

5.1.1 Define a vector and represent a vector geometrically.
5.1.2 Name a directed line segment as a vector.
5.1.3 Write different types of vectors.
5.1.4 Write addition and subtraction of vectors in terms of the segment.
5.1.5 Explain the position vector of a point with reference to a point.
5.1.6 Write the conclusion of difference of two vectors with same initial point as position vector of a point.
5.1.7 Define vector in a plane and vector in a space in terms of unit vectors \(i, j\) and \(k\) respectively.
5.2.1 Write types of vector product (a) Scalar product (b) Vector product
5.2.2 Define scalar product and vector product.
5.2.3 Interpret product of vectors geometrically.
5.2.4 Design the product of vectors to find angle between them and unit vector
5.2.5 Apply product of vectors to find (i) projection of a vector on another vector (ii) Area of triangle and parallelogram (iii) work done by a Force (application of scalar product) (iv) moment of a force (application of vector product)

**TRIGONOMETRY**

**UNIT – 6: UNIT AND MEASUREMENT OF ANGLE** 3 Hr

**GENERAL OBJECTIVES.**

6.1 To understand the concept of angle, unit and its measurement.

**SPECIFIC OBJECTIVES.**

6.1.1 Define an angle.
6.1.2 Define a right angle in different systems.
6.1.3 Define radian.
6.1.4 Obtain relations between radian and degree.
6.1.5 Solve problems.
6.1.6 Prove the radian as a constant angle.
6.1.7 Derive \( l = r\theta \)
6.1.8 Derive area of sector = \( (r^2\theta) / 2 \).
6.1.9 Solve related problems.

**UNIT – 7: TRIGNOMETRIC RATIOS** 4 Hr

**GENERAL OBJECTIVES.**

7.1 To understand trigonometric ratios.
7.2 To comprehend trigonometric ratios of standard angles.

**SPECIFIC OBJECTIVES.**

7.1.1 Define trigonometric ratios for an acute angle.
7.1.2 Derive important formulae (identities)
7.1.3 Solve problems using identities.
7.1.4 Obtain trigonometric ratios of standard angles $0^\circ$, $30^\circ$, $45^\circ$, $60^\circ$, $90^\circ$
7.1.5 Solve problems using standard values.

UNIT – 8: ALLIED ANGLES  

GENERAL OBJECTIVES.

8.1 To understand allied angles of the type $(n\pi/2 \pm \phi)$.

SPECIFIC OBJECTIVES.

8.1.1 Define positive and negative angles.
8.1.2 Give examples to differentiate positive and negative angles.
8.1.3 Explain trigonometric ratios in different quadrants and assign signs.
8.1.4 Define allied angles in different quadrants.
8.1.5 Write formulae of $90\pm \phi$, $180\pm \phi$, $270\pm \phi$, $360\pm \phi$ and $(-\phi)$
8.1.6 Solve problems on allied angles.

UNIT - 9: HEIGHTS AND DISTANCES  

GENERAL OBJECTIVES.

9.1 To understand the measurement of Heights and Distances using trigonometry.

SPECIFIC OBJECTIVES.

9.1.1 Define angle of elevation and angle of depression.
9.1.2 Define the “Height” and “Distance”
9.1.3 Solve problems on height and distance.

UNIT – 10: COMPOUND ANGLES  

GENERAL OBJECTIVES.

10.1 To understand compound angles.

SPECIFIC OBJECTIVES.

10.1.1 Define a compound angle.
10.1.2 Give examples for compound angles.
10.1.3 Derive the formula of $\sin(A+B)$ and $\cos(A+B)$ geometrically.
10.1.4 Obtain $\tan(A+B)$ in terms of $\tan A$ and $\tan B$ using $\sin(A+B)$ and $\cos(A+B)$. 
10.1.5 Obtain formula for sin(A-B), cos(A-B) and tan(A-B).
10.1.6 Solve the problems on compound angles.

UNIT – 11: MULTIPLE AND SUBMULTIPLE ANGLES.  3 Hr

GENERAL OBJECTIVES.

11.1 To understand multiple and sub multiple angles.

SPECIFIC OBJECTIVES.

11.1.1 Define multiple and submultiple angle with example.
11.1.2 Derive the formulae for trigonometric ratios of 2A and 3A using compound angle formulae.
11.1.3 Deduce half angle formulae from the ratio of 2A formulae.
11.1.4 Solve problems.

UNIT – 12: TRANSFORMATION FORMULAE  4 Hr

GENERAL OBJECTIVES.

12.1 To understand transformation formulae.

SPECIFIC OBJECTIVES.

12.1.1 Obtain expressions for sinC ± sinD and cosC ± cosD in terms of Product of trigonometric ratios.
12.1.2 Derive expressions for sinAcosB, cosAsinB, cosAcosB and sinAsinB in terms of the sum and difference of trigonometric ratios.
12.1.3 Solve problems.

UNIT – 13: PROPERTIES AND SOLUTIONS OF TRIANGLES  4 Hr

GENERAL OBJECTIVES.

13.1 To understand the properties of triangles in order to solve them.

SPECIFIC OBJECTIVES.

13.1.1 Obtain sine rule, cosine rule and tangent rule for any angle of a triangle.
13.1.2 Write half angle formulae in terms of sides of a triangle (no proof).
13.1.3 Solve simple problems on above rules.
13.1.4 Find the solution of a triangle in the following cases when (i) all sides are given
(ii) two sides and included angle is given (iii) two angles and one side is
given.(iv) two sides and non included angle is given.

UNIT – 14: INVERSE TRIGNOMETRIC FUNCTIONS. 2 Hr

GENERAL OBJECTIVES.

14.1 To understand inverse trigonometric functions.

SPECIFIC OBJECTIVES.

14.1.1 Define inverse trigonometric function.
14.1.2 Write principal values of trigonometric functions.
14.1.3 Prove standard results like
   1. \( \sin^{-1} x + \cos^{-1} x = \tan^{-1} x + \cot^{-1} x = \cosec^{-1} x + \sec^{-1} x = \pi/2 \),
   2. \( \tan^{-1} x \pm \tan^{-1} y = \tan^{-1} \left( \frac{x \pm y}{1 \mp xy} \right) \)
14.1.4 Solve the problems on inverse functions.

ANALYTICAL GEOMETRY

UNIT – 15: BASIC CONCEPTS OF POINT AND LOCUS 6 Hr

GENERAL OBJECTIVES.

15.1 To understand the basic concepts of point and locus.

SPECIFIC OBJECTIVES.

15.1.1 Define coordinates in two dimensional space.
15.1.2 Define a point in terms of coordinates.
15.1.3 Obtain equation for the distance between two points in terms of coordinates.
15.1.4 Solve problems on above formula.
15.1.5 Explain the section of a straight line.
15.1.6 Derive section formula for internal division.
15.1.7 Write section formula for external division.
15.1.8 Write formula for mid point of a line.
15.1.9 Solve problems on internal and external division.
15.1.10 Define locus of a point.
15.1.11 Solve problems on locus of a point.
UNIT – 16: STRAIGHT LINES

6 Hr

GENERAL OBJECTIVES.

16.1 To understand straight lines.

SPECIFIC OBJECTIVES.

16.1.1 Define angle of inclination.
16.1.2 Define slope of a straight line.
16.1.3 Define x and y intercepts for straight line.
16.1.4 Write $\tan \theta = \frac{m_2 - m_1}{1 + m_2 m_1}$
16.1.5 Write angle between two straight lines in terms of $\tan \theta = \frac{m_2 - m_1}{1 + m_2 m_1}$
16.1.6 Write the conditions for two lines to be parallel and to be perpendicular to each other.
16.1.7 Solve problems.
16.1.8 Derive the slope-intercept form of an equation of a straight line $y = mx + c$
16.1.9 Obtain the point – slope form equation to the straight line $y - y_1 = m(x - x_1)$
16.1.10 Obtain two point form of the equation to a straight line $y - y_1 = \frac{y_2 - y_1}{x_2 - x_1}(x - x_1)$
16.1.11 Obtain intercepts form of the equation to a straight line, $\frac{x}{a} + \frac{y}{b} = 1$
16.1.12 Derive the normal form of equation to a straight line, $xcos \alpha + ysin \alpha = p$
16.1.13 Write the general form of equation to a straight line, $ax + by + c = 0$
16.1.14 Solve problems on different forms of equation.
16.1.15 Solve problems to find an equation of a straight line passing through the given point and parallel to the given line.
16.1.16 Solve problems to find an equation of a straight line passing through the given point and perpendicular to the given line.
16.1.17 Solve problems to find an equation of straight line passing through the intersection of given lines.
16.1.18 Obtain the condition for the intersection of three lines express in general in the determinant form.
16.1.19 Solve the problems on the above condition.
REFERENCE BOOKS:
1. First and Second PUC mathematics Text Books of different authors.
2. Text Book of mathematics –I for polytechnic-by different authors
3. Text Book of mathematics-II for polytechnic- by different authors

*****************************************************************************
BOARD OF TECHNICAL EXAMINATION – KARANATAKA

MODEL QUESTION PAPER

APPLIED MATHEMATICS –I ( FOR ALL COURSES)

Time: 3 Hrs Max.m marks:100

NOTE: i) Answer any 10 questions in section A, 5 questions in section B
     8 questions in section C, & 3 questions in D
     ii) Each question carries 2 marks in section A
     ii) Each question carries 5 marks in remaining section

SECTION – A

1. Find x if
\[
\begin{vmatrix}
1 & 2 & 3 \\
4 & 5 & x \\
7 & 8 & 9
\end{vmatrix} = 0
\]

2. If \( A = \begin{bmatrix} 1 & -2 \\ 3 & 5 \end{bmatrix} \), Find \( \text{adj}(A) \)

3. Find the 5th term in \( \sqrt{x} + \frac{3}{\sqrt{x}} \)

4. If \( \vec{a} = 2i + 3j - 2k \) and \( \vec{b} = i + 2k \), find \( \vec{a} \cdot \vec{b} \)

5. If \( \vec{p} = i + J -2k \), Find unit vector in the direction of \( \vec{p} \)

6. If \( \sin\theta + \cosec\theta = \frac{1}{2} \), find \( \sin^2\theta + \cosec^2\theta \)

7. If \( \sec \theta = \cosec3\theta \), find \( \theta \).

8. Find the value of \( \tan15^\circ \) without using table or calculator.

9. Show that \( \frac{\theta}{2} = \frac{\sin\theta}{1+\cos\theta} \)
10. Show that \( \frac{\cos 17^\circ - \sin 17^\circ}{\cos 17^\circ + \sin 17^\circ} = \tan 28^\circ \)

11. Show that \( \tan \frac{\theta}{2} = \sqrt{\frac{(s-b)(s-c)}{s(s-a)}} \)

12. Show that \( \cos^{-1}(-x) = \pi - \cos^{-1} x \)

13. Find the locus of a point which moves at a equal distances from the axis

14. Find the inclination and Y-intercept of the line \( \sqrt{3}x + y = 3 \)

15. Find the angle between the lines who’s slopes are \( \sqrt{3} \) and \( 1/\sqrt{3} \)

**SECTION – B**

1. Solve the following equations by cramer’s rule

\[
2x + y = 1, \quad y + 2z = 7 \quad \text{and} \quad 3z - 2x = 11
\]

2. Find the inverse of the matrix \( A = \begin{bmatrix} 1 & 2 & 5 \\ 0 & -1 & 3 \\ 3 & 1 & 2 \end{bmatrix} \)

3. Verify Cayley-Hamilton Theorem for the matrix \( A = \begin{bmatrix} 2 & -1 \\ 1 & 5 \end{bmatrix} \)

4. Find the co-efficient of \( x^{18} \) in \( (x^2 + \frac{3a}{x})^{15} \)

5. If \( \log_a (bc) = x \), \( \log_b (ac) = y \) and \( \log_c (a \ b) = z \). Show that \( \frac{1}{1+x} + \frac{1}{1+y} + \frac{1}{1+z} = 1 \)

6. Find the sin of the angle between the vectors \( (3,2,1) \) and \( (2,-1,4) \)

7. If the position vectors of A, B,C are respectively \( i+2j+3k \), \( 2i+5j-k \) and \( -i+j+2k \), find the area of triangle ABC

8. Find the projection of vector \( 2i + 3j + 2k \) on \( 4i + 5j + 3k \)

**SECTION – C**
1. Circular wheel is rotating at the rate of 450 r.p.m. If the radius of the wheel 70cm, find the distance covered by a point on the rim in 1 second.

2. Prove that \( \frac{\tan \theta + \sec \theta - 1}{\tan \theta - \sec \theta + 1} = \frac{1 + \sin \theta}{\cos \theta} \)

3. Show that \( \frac{\sin \theta + 1 + \cos \theta}{1 + \cos \theta + \sin \theta} = 2 \cos ec \theta \)

4. Show that \( \sin 420^\circ \cos 390^\circ + \cos(-300^\circ) \sin(-330^\circ) = 1 \)

5. Simplify \( \frac{\cos \left( \frac{\pi}{2} + \theta \right) \sec(-\theta) \tan(\pi - \theta)}{\sec(2\pi - \theta) \sin(\pi + \theta) \cot \left( \frac{\pi}{2} + \theta \right)} \)

6. The angles of elevation of the top of a tower from the base and top of building are 60° and 45°. The building is 20m high. Find the height of the tower.

7. Prove that \( \sum \frac{\sin(A - B)}{\sin A \sin B} = 0 \)

8. Prove that \( \frac{\cos 3A + \sin 3A}{\cos A - \sin A} = 1 + \sin 2A \)

9. Prove that \( \frac{\sin A + \sin 3A + \sin 5A + \sin 7A}{\cos A + \cos 3A + \cos 5A + \cos 7A} = \tan 4A \)

10. In a triangle ABC show that \( \frac{\cos 2A}{a^2} - \frac{\cos 2B}{b^2} = \frac{1}{a^2} - \frac{1}{b^2} \)

11. Solve the triangle ABC if \( a = 2 \), \( C = \sqrt{3} - 1 \), \( B = 120^\circ \)

12. Prove that \( 2 \tan^{-1} \frac{1}{8} + \tan^{-1} \frac{1}{7} + 2 \tan^{-1} \frac{1}{5} = \frac{\pi}{4} \)

**SECTION – D**

1. Find the point on the x-axis which is equidistant form the points (7,6) and (–3,4)
2. Find the co-ordinates of the point of trisection of the median AB of the triangle ABC whose vertices are A(–2, 2 ), B(–1, –3 ) and C (5,7)
3. Find the equation of the line passing through (–2, 6 ) and the sum of intercepts on the co-ordinate axes is 5.
4. Find the equation of the line perpendicular to 3x – 2y + 1 = 0 and passes through(1,–2).
Diploma Course in Mechanical Engineering (WSM)
Second Semester
Subject Title: Mechanical Engineering Science

Contact hrs/week : 4
Contact hrs. / Sem: 64

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<td>Sources of energy</td>
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<tr>
<td>2</td>
<td>Properties of metals</td>
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<td>Ferrous metals</td>
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<td>Heat treatment of steels</td>
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Subject Content

1 **Sources of Energy**
1.1 renewable & non-renewable energy sources
1.2 solar energy, wind energy, hydro energy, tidal energy, geo thermal energy

2 **Properties of metals**
2.1 Meaning of chemical, thermal, electrical, magnetic and mechanical properties of
2.2 Ductility, hardness, toughness, brittleness, impact, malleability, elasticity, plasticity etc

3 **Ferrous metals**
3.1 Principal ferrous metals
3.2 Cast iron and steel
3.3 Cast iron - manufacturing using cupola
3.4 Types of cast iron, composition, properties and uses
3.5 Steel - grades of steel and their composition
3.6 Manufacturing of steel using bessemer convertor process
3.7 Alloying of steel and its purpose
   Composition and uses of - Nickel steel, 18/8 stainless steel,
3.8 HSS, Manganese steel

4 **Non Ferrous metals**
4.1 principal non-ferrous metals
4.2 properties and uses of non-ferrous metals- copper, aluminium, zinc, tin, lead, cobalt, nickel, chromium
4.3 composition, properties & uses
4.3.1 copper alloys- brass & bronze
4.3.2 brass- montz metal, white brass, yellow brass
4.3.3 bronze- bell metal, gun metal & phosphor bronze
4.3.4 aluminium alloys- aluminium bronze, duralumin
4.3.5 magnesium alloys- dove metal & electron metal
4.3.6 nickel alloys- monel metal, nichrome
4.3.7 lead base alloys
4.3.8 tin base alloys- babitt metal
4.3.9 zinc base alloys- bearing metals
5 Heat treatment of steels
5.1 purpose of heat treatment
5.2 heat treatment processes- annealing, normalising, hardening, tempering, nitriding, cyaniding
5.3 engineering applications of the above processes

6 Friction & Lubrication
6.1 introduction
6.2 definition & types of friction
6.3 coefficient of friction
6.4 angle of friction & friction angle
6.5 laws of solid friction
6.6 effect of friction
6.7 necessity of lubrication
6.8 properties of different types of lubricants
6.9 methods of lubrication
6.10 splash, wick, screw cap & needle lubricators

7 Transmission of Power
7.1 introduction
7.2 types of power transmission
7.3 flat belt drives- open & cross belt drives
7.4 velocity ratio, slip & creep
7.5 simple problems
7.6 fast & loose pulley
7.7 cone or stepped pulley, jockey or idler pulley
7.8 v belt drive-advantages & limitations
7.9 rope drive- advantages & limitations
7.10 chain drive- advantages & limitation
7.11 gear drive
7.12 types of gears-spur, helical, bevel, worm & worm wheel, rack & pinion

8 Fasteners
8.1 Intorduction
8.2 classification
8.3 screw thread terminology
8.4 V- threads,square threads, Metric threads,Acme Threads
8.5 single & Multistart threads
8.6 Right & Lefthand threads
8.7 Bolts & Nuts
8.8 LockNut
8.9 Locking devices- split pin,Screw pin,plate & spring washer

9 Bearing
9.1 Need of bearings
9.2 Types- Bush,Pedestal, Footstep bearings
9.3 Ball and roller bearings-needle bearing, thrust bearing
9.4 Advantages and disadvantages of ball and roller bearings

10 Welding , Soldering and Brazing
10.1 Introduction to Welding
10.2 Classification of welding
10.3 Applications of welding
10.4 Arc welding
10.5 Gas welding
10.6 Introduction to Soldering and Brazing
10.7 Comparison of welding with Soldering and Brazing

**General Objectives**
1. To know the different solar energy sources and their applications
2. To know the different uses of metals with their properties
3. To know ferrous metals and their preparation and types
4. To know the different nonferrous metals and their types with applications
5. To know the importance of heat treatment and its processes
6. To know about the friction and lubrication processes
7. To know the different modes of transmission of power and applications
8. To know the different fastening members and their applications
9. To know the importance of bearings and their types
10. To understand the processes of welding, brazing and soldering and their applications

**specific instructional objectives:**

1. Appreciate the uses of different sources of energy
   1.1 Define renewable and non-renewable energy sources

2. Appreciate the use of different metals in mechanical engineering
   2.1 Name the metals used in industries
   2.2 Define chemical, magnetic, electrical, thermal & mechanical properties of metals
   2.3 Know the importance of the above properties

3. Appreciate the use of ferrous metals in industries
   3.1 List the principal ferrous metals
   3.2 Sketch and explain cupola
   3.3 Know the manufacturing of cast iron
   3.4 List the types of cast iron with composition, properties and uses
      Know the manufacturing of steel by Bessemer converter
   3.5 Process
   3.6 State the composition and uses of various grades of steel
   3.7 Define alloying and state its purpose
   3.8 State the composition, properties and uses of nickel steel, chromium steel, 18/8

4. Appreciate the use of non-ferrous metals in industries
   4.1 List different non-ferrous metals used in industries
   4.2 State the properties and uses of copper, zinc, aluminium, lead, tin, cobalt, nickel and
   4.3 State the composition, properties & uses of
      4.3.1 Copper alloys- brass & bronze
      4.3.2 Brass- montz metal, white brass, yellow brass
      4.3.3 Bronze- bell metal, gun metal & phosphor bronze
      4.3.4 Aluminium alloys- aluminium bronze, duralumin
      4.3.5 Magnesium alloys- dove metal & electron metal
      4.3.6 Nickel alloys- monel metal, nichrome

Page 3 of 7
4.3.7 lead base alloys
4.3.8 tin base alloys- babitt metal
4.3.9 zinc base alloys- bearing metals
4.3.10 discuss the engineering application of the above non-ferrous alloys

5 state the objectives of heat treatment of steel
5.1 explain annealing, normalising, hardening, tempering, nitriding, cyaniding with its

6 know the role of friction and lubrication in machine elements
6.1 define force of friction
6.2 state laws of solid friction
6.3 identify the need for lubrication
6.4 list types of lubrication
6.5 list the properties of lubricants
6.6 list the types of lubricators
6.7 explain wick lubricator, splash lubrication, screw cap lubricator, needle lubricator

7 understand transmission of power in machines
7.1 list the types of transmission of power
7.2 explain open and cross belt drive
7.3 define velocity ratio
7.4 state the effect belt thickness and slip on velocity ratio
7.5 explain the use of cone pulle, idler pulley and fast & loose pulley in belt drive
7.6 explain the advantages of v-belt drive over flat belt drive
7.7 list the advantages and disadvantages of rope drive
7.8 list the advantages and disadvantages of chain drive
7.9 list the types of gear drives
7.10 gear drives
7.11 solve simple problems on velocity ratio and slip in flat belt drives

8 appreciate the application of fasteners
8.1 define fastener and fastening
8.2 classify fasteners
8.3 classify threaded fasteners
8.4 explain screw thread terminology
   explain application of v-thread, metric thread, square thread & acme thread in the
8.5 field of engineering
8.6 explain single and multi start thread
8.7 explain right and left hand thread
8.8 explain the principle of lock nut
8.9 explain the locking of nut using split pin, screw pin, plate and spring washer

9 discuss the importance of bearings in industries
9.1 classify bearings
9.2 explain bush bearings and state its industrial application
9.3 explain plummer block and state its industrial application
9.4 explain foot step bearing
9.5 discuss the types of antifriction bearings with engineering application

10 Explain the welding and its concepts
10.1 Classification on the basis of fusion and non fusion ,pressure and non pressure .
10.2 Different areas of use of welding
10.3 Principle of Arc welding(with sketch) including all equipments ,preparation ,precautions and procedure
10.4 Principle of Gas welding(with sketch) including all equipments ,preparation ,precautions and procedure
10.5 Explain the clear concepts of soldering and brazing
10.6 Comparison of welding, soldering and brazing

**Reference Books**

1. Mechanical Engineering science- K. R. Gopala Krishna
2. Elements of mechanical engineering- K.P. Roy & Hajra Choudary
3. Elements of mechanical engineering- K.R. Gopala Krishna
4. Engineering materials- Hajra Choudary
5. Engineering materials- Rangawala
6. Engineering materials- Roy & Choudary
7. Materials & metallurgy- J.K. Gupta

**Question Paper Pattern and Marks Distribution**

Subject Title: Mechanical Engineering Science
First Semester

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UNIT I

Fill in the blanks with appropriate word

1 _________ is an example of renewable energy source

2 Welding has been classified as _________ type of fastener

3 _________ pulley is being used to increase the velocity ratio of

3 the belt drive

4 Cupola furnace is used to manufacture _________

UNIT II

1 a) Differentiate between renewable and non-renewable energy sources 3
b) Write short note on Wind energy 5
c) Sketch and explain Cupola Furnace 8

2 a) Define alloy and state the purpose 3
b) state the properties and uses of non ferrous metals 5
c) explain ductility, malleability, plasticity and elasticity 8

3 a) list various grades of steel 3
b) Write short note on copper 5
c) explain with neat sketch the manufacturing process of steel
by Bessemer Convertor 8

UNIT III

4 a) List the need of heat treatment of steel 3
b) explain effect of belt thickness on velocity ratio 5
c) In a open belt drive, the driving pulley diameter is 0.6m and
is running at 1200rpm. The driven pulley diameter is 0.2m.
Determine speed of the driven pulley, velocity ratio if the
thickness of the belt is 10mm. 8

5 a) List the advantages of v belt over flat belt 3
b) List the properties of good lubricants 5
c) With neat sketch explain screw cap lubricator 8

6 a) list the advantages and disadvantages of chain drive 3
b) with neat sketch expalain rack and pinion 5
c) Explain annealing and tempering process 8

UNIT IV

7 a) define fastener and fastening 3
b) explain screw thread terminology 5
c) with neat sketch explain locking of nut using split pin 8

8 a) list the classification of bearings 3
b) explain bush block 5
c) with neat sketch explain different types of gas flame 6

9 a) List precautions to be followed in arch welding 3
b) explain different applications of gas welding

c) explain with neat sketch the principle of arc welding
Department of Technical Education  
Diploma Courses in Auto, Mech, MTT, Chem, textiles, mining, mechatronics, printing, metallurgy

**Second Semester**  
Sub: Basics of Electrical and Electronics Engineering  
Contact Hrs / Week: 4  
Contact hrs / Semester: 64

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<tr>
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<td>Electric current, Voltage and circuits</td>
<td>09hrs</td>
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<td>3.0</td>
<td>Work, power and energy</td>
<td>04 hrs</td>
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<td>4.0</td>
<td>Magnetic fields and circuits</td>
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<td>5.0</td>
<td>Electromagnetic induction</td>
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<td>Alternating current and circuits</td>
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<td>13.0</td>
<td>Integrated Circuits</td>
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Revision and Tests  

Total  
64hrs
## Curriculum Content

### 1.0 Concept of Electrical energy 02 hrs
- 1.0 Application of electrical energy
- 1.1 Advantages of Electrical energy
- 1.2 Sources of electrical energy
- 1.3 Effects of electric current and practical applications of these effects

### 2.0 Electric current, Voltage and circuits 09hrs
- 2.1 Electric current and its unit.
- 2.2 Instrument used for measurement of current.
- 2.3 emf, potential difference and its unit.
- 2.4 Instrument used for measurement of voltage.
- 2.5 Concept of conductors, insulators and semiconductors.
- 2.6 Resistance, its unit.
- 2.8 Instrument used for measurement of resistance.
- 2.9 Ohm’s law, its applications.
- 2.10 Simple problems of Ohm’s law.
- 2.11 Series and Parallel Circuits.
- 2.12 Simple problems of series parallel circuits.

### 3.0 Work, power and energy 04 hrs
- 3.1 Electrical power, energy, work and their units.
- 3.2 Measurement of power and energy.
- 3.3 Conversion of mechanical units into electrical units and vice versa.
- 3.4 Simple problems on work, power, and energy.

### 4.0 Magnetic fields and circuits 03 hrs
- 4.1 Definition of terms magnetic field, magnetic flux, mmf reluctance and flux density.
- 4.2 Units of magnetic field, magnetic flux, mmf reluctance and flux density.

### 5.0 Electromagnetic induction 04 hrs
- 5.1 Faraday’s laws of electromagnetic induction.
- 5.2 Statically induced emf.
- 5.3 Dynamically induced emf.
- 5.4 Self induced emf.
- 5.5 Mutually induced emf.

### 6.0 Alternating current and circuits 06 hrs
- 6.1 Concept of alternating current.
- 6.2 Definition of terms - amplitude, instantaneous value, time period, cycle, frequency, rms value, average value, form factor and their units.
- 6.3 Inductance, capacitance, reactance, impedance and their units.
- 6.4 Power and power factor.
- 6.5 Difference between single phase and three phase circuits.
- 6.6 Simple problems on power and power factor.
7.0 Electrical Machines

Transformers

7.1 Function of a transformer
7.2 Types of transformer.
7.3 Applications of different types of transformers
7.4 Electrical characteristics of welding transformer

DC Generators

7.5 Function of a DC Generator.
7.6 Types of DC Generators.
7.7 Applications of different types of dc generators

DC Motors

7.8 Function of a DC Motor.
7.9 Types of DC Motors
7.10 Applications of different types of dc motors

AC Generators

7.11 Function of a AC Generator.
7.12 Applications of AC generators

AC Motors

7.13 Function of a AC Motor
7.14 Types of AC motors
7.15 Difference between single and three phase motors
7.16 Applications of single and three phase motors
7.17 Types of mechanical enclosures and their importance, and application.
7.18 types of FHP motors and their application.
7.19 Necessity of starters
7.2 Types of starters
7.21 Name plate details of motors.

8 Electric cables

02hrs

8.1 Introduction to underground Electric cables
8.2 Types with advantages & Limitations of cables.
8.3 Applications of Cables.

9.0 Protective devices

2hrs

9.1 Necessity of Protective devices
9.2 fuses - Rewirable & HRC, Breakers - MCB & ELCB.
9.3 flame proof enclosures used in switchgear.
9.4 Necessity of electrical earthing.
9.5 General electrical safety precautions.

10.0 Battery and maintenance

3hrs

10.1 Function of Batteries
10.2 types of batteries
10.3 conditions of fully charged battery
10.4 types of charging of batteries
10.5 maintenance free battery

Advantages of SMF (Sealed Maintenance Free) Batteries over
10.6 Conventional Batteries.
10.7 Applications of Batteries.
11.0 Lighting 2hrs

11.1 List electrical sources of light
11.2 Function and applications of
   a) Incandescent lamp
   b) Fluorescent
   c) Mercury vapour lamp
   d) Sodium vapour lamp
11.3 Salient features of Industrial lighting.

12.0 Electronic components and their applications 10hrs

12.1 Semiconductor materials, P type and N type
12.2 Intrinsic and extrinsic Semiconductor.
12.3 Semiconductor diodes and their application
12.4 Half and full wave rectifiers circuits
12.5 Filter circuits
12.6 Zener diode and their applications
12.7 Zener diode as voltage regulator.
12.8 Light Emitting Diodes and their application
12.9 Transistors and their application.
12.10 Transistor as a Amplifier
12.11 Silicon Controlled Rectifier and their application.
12.12 Electronic timers
12.13 Relays

13.0 Integrated Circuits 4hrs

13.1 Logic functions
13.2 Logic gates- NOT, AND, OR, NAND, NOR
13.3 Fundamentals of IC
13.4 Application of IC's
SPECIFIC OBJECTIVES

1.0 Concept of Electrical energy
1.1 Know the use of electrical energy
1.2 Understand the benefits of Electrical Energy
1.3 List the Sources of Electrical energy
1.4 Know the effects of electrical current and their applications.

2.0 Electric current, Voltage and circuits
2.1 Understand the concept of Electric current, emf, potential difference
2.2 Know the units of current, emf, potential difference
2.3 Know the types in instruments used to measure current, emf, potential difference
2.4 Definition of conductors, insulators and semiconductors
2.5 Interpret resistance and know its unit
2.6 Recognize the instruments used to measure resistance
2.7 State and explain Ohm's law
2.8 Analyze series and parallel circuits

3.0 Work, power and energy
3.1 Understand the concept of Electrical power, energy, work and their units
3.2 Know the measurement of power and energy
3.3 Perform the conversion of mechanical units into electrical units and vice versa

4.0 Magnetic fields and circuits
4.1 Define magnetic field, magnetic flux, mmf, reluctance and flux density.
4.2 Know the units of magnetic field, magnetic flux, mmf, reluctance and flux density

5.0 Electromagnetic induction
5.1 Understand Faraday's laws of electromagnetic induction
5.2 Explain Statically induced emf
5.3 Explain Dynamically induced emf
5.4 Explain Self induced emf
5.5 Explain mutually induced emf

6.0 Alternating current and circuits
6.1 Understand the concept of alternating current
6.2 Define the terms amplitude, time period, instantaneous value, cycle, frequency, rms value, average value, form factor and their units.
6.3 Explain inductance, capacitance, reactance, impedance and their units
6.4 Define power and power factor
6.5 list the differences between single phase and three phase supply
7.0 Electrical Machines 09hrs

Transformers
7.1 Know the function of a transformer
7.2 List the types of transformers
7.3 Write the applications of different types of transformers
7.4 List the characteristics of a welding transformer.

DC Generators
7.4 Know the function of DC generators.
7.5 List the types of DC generators
7.6 List the applications of different types of dc generators

DC Motors
7.6 Know the function of a DC Motor.
7.7 List the types of DC motors
7.8 List the applications of different types of dc motors

AC Generators
7.9 Know the function of a AC Generator.
7.10 List the applications of ac generators

AC Motors
7.11 Know the Function of a AC Motor.
7.12 List the types of AC motors
7.13 List the applications of single and three phase motors
7.14 List the differences between single and three phase motors
7.15 List the differences between single and three phase motors
7.16 List the different types of Mechanical Enclosures of Motors
7.17 Identify the working place of where the different enclosures are used.
7.18 List the importance of different types of Mechanical Enclosures of Motors
7.19 List the types of FHP motors
7.20 List the applications of FHP motors
7.21 Understand the necessity for starters
7.22 List the types of starters used in starting Induction Motors
7.23 Understand the meaning of overload Starters
7.24 Understand the meaning single phase protection in Starters
7.25 List the general name plate details of A C motors.

8 Electric cables 02hr
8.1 Understand the underground cable
8.2 List the types of underground cable
8.3 List the advantages and limitations of underground cables over overhead cables.
8.4 List the applications of underground cables

9.0 Protective devices 02hrs
9.1 Understand the necessity of protective devices
9.2 List the different protective devices
9.3 Explain fuse- HRC, rewirable fuse
9.4 Explain the need of MCB, ELCB
9.5 Understand the importance of flame proof enclosure used in protective devices.
9.6 State the necessity of electrical earthing
9.7 Mention the general electrical safety precaution
10.0 Battery and maintenance 03hrs
10.1 Explain battery
10.2 Name type of batteries as lead acid, nickel iron and nickel cadmium
10.3 State variations in specific gravity during charging and discharging
10.4 State applications of batteries.
10.5 Explain charging of batteries by a) Constant current method
       b)Constant voltage method
10.6 Explain trickle charging
10.7 Explain the indications of a fully charged battery
10.8 Explain sealed maintenance free(SMF) batteries.
10.9 State advantages of maintenance free batteries over conventional batteries.

11.0 Lighting 02hrs
11.1 List the electric sources of light
11.2 Function and applications of
       a) incandescent lamp.
       b) fluorescent lamp
       c) sodium vapour lamp
       d) mercury vapour lamp
11.3 List the salient features of good industrial lighting.

12.0 Electronic components and their applications 10 hrs
12.1 Understand semiconductor material
12.2 Differentiate between intrinsic and extrinsic semiconductors.
12.3 Understand Semiconductor diodes
12.4 Briefly explain V-I characteristics of a semiconductor diode.
12.5 List the applications of semiconductor diode
12.6 Explain with circuit the working of Half wave rectifier
12.7 Explain with circuit the working of centertapped full wave rectifier
12.8 Explain with circuit the working of bridge full wave rectifier
12.9 Know Zener diodes
12.10 Explain V-I characteristics of a zener diode.
12.11 Briefly explain the use of Zener diode as a voltage regulator.
12.12 List the applications of zener diode
12.13 Understand Light Emitting Diodes
12.14 Understand with circuit working of a transistor
12.15 List the applications of transistor
12.16 Sketch and explain Silicon Controlled Rectifier
12.17 List the applications of Silicon Controlled Rectifier
12.18 State the necessity for timers
12.19 List the different types of times (electronic, mechanical, thermal etc)
12.20 State the working principle of a relay
12.21 Name the different types of contacts in relays(NC and NO)
12.22 List the applications of relays
13.0 Integrated Circuits 04hrs

13.1 Explain logic high and low (1 and 0)
13.2 Explain NOT, AND, OR logic functions
13.3 Understand Logic gates-AND, OR, NOT, NAND, NOR
13.4 Draw the logic symbols and truth table of AND, OR, NOT, NAND, NOR
13.5 Explain the meaning of IC
13.6 List the advantages of IC

Text Books:
1. Basic Electrical and Electronics Engg. by K S Shashidhar, Sapna

References:
1) Electrical Technology- by B.L.Theraja
2) Basics Electrical and Electronics Engg. by K.V.N Gowda
3) Principles of Electrical Engineering by Deltoro
4) Principles of Electrical & Electronics Engineering by V.K.Mehta
5) Electric power by Uppal
6) Switchgear and protection by Sunil S.Rao
7) Digital Principles and application by Malvino and Leech
8) Digital Principles and application by Floyd
9) Electronics Devices and application -Motorshed
10) Electronics devices by Floyd
Publications.
Contact Hrs / Week: 6  

1. Study experiments:  
   1.1 Study of safety precautions and First aid  
   1.2 Study of different supply systems like AC, DC  
   1.3 Study of volt meter, ammeter, Watt meter, energy meter, multimeters  
   1.4 Study of different types of wires and cables  
   1.5 Study of safety devices like fuses, MCB and ELCB  
   1.6 Study of different types of earthings  
   1.7 Study of AC machines, DC machines and Transformers  
   1.8 Study of different types of wiring systems  
   1.9 Study of different electronic components, CRO and soldering iron  
   1.10 Study of Transducers and Sensors  
   1.11 Battery charging and checking the specific gravity using Hydrometer  

Total 39hrs

2. EXPERIMENTS FOR CONDUCTION:  
   2.1 Conduct an experiment to verify Ohm's law  
   2.2 Conduct an experiment to measure the power and power factor in a 1-phase AC Circuit  
   2.3 Conduct an experiment to measure the energy consumed in a single phase AC systems using 1-phase Energy Meter  
   2.4 Conduct an experiment to determine Voltage and Current ratio of a given single phase transformer  
   2.5 Control of Single lamp from one place  
   2.6 Control of Single lamp and Three pin socket independently  
   2.7 Control of Single lamp from two places independently (Staircase wiring system)  

Total 39hrs
2.8 Wiring up of a fluorescent lamp 3hrs

2.9 Wiring of meterboard using energymeter, MCB, kitkat fuse unit and with a neutral link. 3hrs

2.10 Start and reverse the direction of rotation of a Single phase Induction Motor 3hrs

2.11 Using a suitable starter, start and reverse the direction of rotation of a three phase Induction Motor 3hrs

2.12 Conduct an experiment to draw the V-I characteristics of junction diode 3hrs

2.13 Conduct an experiment to draw the V-I characteristics of Zener Diode 3hrs

2.14 Conduct an experiment to trace the output waveforms of halfwave rectifier 3hrs

2.15 Conduct an experiment to trace the output waveforms of fullwave bridge rectifier 3hrs

2.16 Conduct a suitable experiment to verify NOT, AND, OR, NOR and NAND gates truth table 3hrs

3. TESTS & ASSIGNMENTS 3hrs

Grand Total: 96HRS

REFERENCE BOOKS:
1) A Text book on Laboratory courses in Electrical Engg. by S.G. Tarnekar and P.K. Karbanda
2) Electrical lab manual prepared by SJ(Govt) Polytechnic, Bangalore

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Contact hrs/week: 2hrs Theory + 4hrs Sketching & Practice

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Subject Contents

1 Introduction to CAD
   Introduction to software interface
   Standard toolbar/menus
   Understanding the co-ordinate systems-2D and 3D
   Visualization
   Setting the Paper sizes and inserting the title blocks

2 Section of Solids
   Sectional views of cube, prisms and pyramids like square, pentagonal, hexagonal. Cone and cylinders resting with base on HP with axis parallel or perpendicular to HP only

3 Section of Machine Parts
   Need for sectioning
   Sectional views, Cutting plane, Type of Sections, Full section, Half section, Top half in section, Bottom half in section, Right half in section, Left half in section, Revolved section, Offset section, Local section, Thin section and hatching section.
   Practice on sectioning.

4 Development of surfaces
   Importance of development of surfaces in sheet metal works
   Developments of surfaces of following solids - cube, prism, pyramid, cylinder, cone, truncated cylinders and cones
   Development drawings of the following:
   3.1 Tray
   3.2 Funnel
   3.3 Elbow of 90 degree
   3.4 Rectangular duct
   Practice on developments

5 Projection of orthographic views to Isometric Projection
   Isometric axis, Isometric lines, Isometric planes, Non Isometric lines, Isometric scale
To distinguish between Isometric view and Isometric projection.

Isometric views of rectangles, circles, objects like cube, prism, pyramid, cone, frustum of cone, cylinder, sphere and built up solids
Isometric views of machine parts like bearing block, step block, V-block, fork lines, shaft brackets when orthographic views are given

6 Fasteners
Temporarily fastenings - screw threads, bolts and nuts
Screw threads - conventional symbols for representation of internal and external threads - metric threads - left hand and right hand - multi starts tghreads
Drawing the three view of Hexagonal nut and square nut
Draw the two views of a hexagonal headed bolt with hexagonal nut and washer
Draw the two views of a square headed bolt with square nut
Draw the views of various locking nuts
Sketch the rivet and riveting joints - single rivetted lap joint, double rivetted joint (chain and zig-zag), single cover plate, single and double rivetted butt joint, double cover plate butt rivetted joints.

7 Limits, Fits, Tolerances and Surface Finish
Limits, Fits, Tolerances, different types of fits, hole based system, shaft based system selection of fits and applications, Types of tolerances, indication of tolerances, surface quality symbols.

Reference books
1 Elementary engineering drawing : N.D.Bhatt
2 Engineering Drawing : K.R. Gopal krishna
3 Fundamentals of engineering drawing : R.K. Dhawan
4 Computer Aided Engineering Drawing - S. Trymbaka Murthy
5 Fundamentals of engineering drawing with an introduction to interactive computer graphics for design
6 Engineering Drawing : I.S. Morries
7 Step by step engineering drawing : Vee Ess
8 Engineering graphics : Verges

Scheme of Examination
1 Chapter 1 & Chapter 7 is only for practice and internal assessment and not for examination
2 Internal Assessment may be calculated as follows - 10 marks for Worksheets (Lab Record), 10 marks for (Best of Two Tests) & 05 marks for Attendance (as per BTE Norms)
3 Three questions must be set by the practical examiner as per the following pattern

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Note: 1 This Syllabus is common to Mechanical, Automobile, HPT, MTT, WSM, IT (Mech), Chemical, Metallurgy, Aeronautical & Polymer Technology and this subject is to be taught by respective department faculties.
2 The practical may be taught using any suitable softwares like Autocad, Solidedge, Unigraphics, Catia etc
3 This information is available in the DTE official Website http://dte.kar.nic.in
## ENGLISH COMMUNICATION

### TABLE OF SPECIFICATIONS

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Department of Technical Education
All Diploma Courses in Engineering and Technology Streams
First or Second Semester
ENGLISH COMMUNICATION

Contact Hrs./Week: 4                                         Contact Hrs. / Semester: 64

GOAL: IMPROVEMENT OF ENGLISH COMMUNICATION SKILLS OF I OR II SEMESTER STUDENTS OF DIPLOMA COURSES IN ENGINEERING AND TECHNOLOGY.

SPECIFIC INSTRUCTIONAL OBJECTIVES:

1    READING SKILL
     The student is able to:
1.1 Understand the difficult words and phrases in the lesson
1.2 Use the words and phrases correctly in his own sentences
1.3 Read the lesson properly without mistakes
1.4 Read the given passage correctly.

2    WRITING SKILL
     The student is able to
2.1 Write the answers correctly to the questions on the lessons
2.2 Write personal letters in the proper format without mistakes
2.3 Use words and phrases in his own sentences
2.4 write grammatically correct sentences.

3    PRACTICAL KNOWLEDGE OF GRAMMAR
     The student is able to
3.1 Use verbs correctly
3.2 Use various phrases appropriately
3.3 Use interrogatives and negatives
3.4 Convert active voice into passive and vice versa
3.5 Frame questions, question tags and give short form answers correctly
3.6 Use prepositions appropriately

4    COMPREHENSION
     4.1 The student is able to read and understand the seen & unseen passages and answer the questions given

5    CREATING AWARENESS
     5.1 The student becomes aware of current environmental issues and about his responsibilities toward environment factors.
     5.2 Awareness about Right to Information Act
CONTENT

“ENGLISH COMMUNICATION FOR POLYTECHNICS” By NITTTR, Chennai and Published by Orient BlackSwan Pvt Ltd, Hyderabad.

1 BOOK

2 GRAMMAR
   2.1 PARTS OF SPEECH
   2.2 COUNTABLE, UNCOUNTABLE AND PROPER; NOUNS
   2.3 USE OF SOME, ANY, MUCH, MANY, A LOT OF, ETC.,
   2.4 MAIN AND AUXILIARY VERBS
   2.5 USES OF TENSES
   2.6 ACTIVE AND PASSIVE VOICE
   2.7 INTEROGATIVES
   2.8 NEGATIVES
   2.9 PREPOSITIONS
   3.1 QUESTION TAGS
   3.2 USE OF ADVERB TOO
   3.3 USING PHRASES IN OWN SENTENCES

3 COMPOSITION & COMPREHENSION
   3.1 WRITING RESPONSE TO PICTURE
   3.2 STORY FROM GIVEN OUTLINES
   3.3 EXPANDING OUTLINES INTO PARAGRAPH
   3.4 PARAGRAPH WRITING USING HINTS
   3.5 COMPREHENSION OF UNSEEN PASSAGE
   3.6 NOTE MAKING
   3.7 DEVELOPING NOTES INTO PARAGRAPHS
   3.8 SUMMERISING

MONTHLY TESTS
READING AND COMPREHENSION EVALUATION
BOARD OF TECHNICAL EXAMINATION –
KARNATAKA

SUBJECT: APPLIED MATHEMATICS – II
For II - Semester

DIPLOMA COURSES OF ALL BRANCHES

Contact hour per week: 04  Contact hour per Semester: 64

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REFERENCE BOOKS:
2. Applied Mathematics –II By Dr. D S Prakash  S Chand Publications
4. Applied Mathematics –II for Polytechnics- By different Authors.
QUESTION PAPER BLUE PRINT
FOR APPLIED MATHEMATICS – II

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APPLIED – MATHEMATICS – II

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Total = 100
Diploma Courses of All Engineering Branches
II Semester
Sub: Applied Mathematics II

CONTENTS

UNIT – 1: LIMITS. 6 Hr.

Variables and Constants. Definition of function. Types of function: Direct and Inverse functions, Explicit and implicit function, Odd and even functions (Definition with examples). Concept of x tends to ‘a’. Definition of limit of a function. Problems on limit of a function by factorization, rationalization when x tend to ‘0’, when x tend to ‘∞’ and x tend to ‘a’. Derivations of algebraic and trigonometric limits. Problems. Standard limit (only statement)

\[ \lim_{x \to 0} \frac{a^x - 1}{x} = \log_a e \quad \lim_{x \to 0} \frac{e^x - 1}{x} = 1 \quad \lim_{n \to \infty} \left(1 + \frac{1}{n}\right)^n = e \quad \lim_{n \to 0} (1 + n)^1 = e \]

Simple problems on standard limits.

UNIT – 2: DIFFERENTIAL CALCULUS. 16 Hr.


UNIT – 3: APPLICATIONS OF DIFFERENTIATION. 6 Hr.

Geometrical meaning of derivative. Equation of tangent and normal to the curve \(y = f(x)\) at a given point. Derivative as a rate measure. Definition of increasing and decreasing function. Maxima and minima of a function.

UNIT – 4: INTEGRAL CALCULUS. 14 Hr.

Definition of Integration. List of standard integrals. Rules of integration (only statement)

\[ \int k f(x) \, dx = k \int f(x) \, dx \quad \int \{f(x) \pm g(x)\} \, dx = \int f(x) \, dx \pm \int g(x) \, dx \]

problems. Integration by substitution method. Problems. Integrals of functions involving \(a^2 + x^2\), \(a^2 - x^2\) and their radicals. Some important integrals of the type
1. \( \int \frac{dx}{x^2 + a^2} = \frac{1}{a} \tan^{-1}\left(\frac{x}{a}\right) + c \)

2. \( \int \frac{dx}{\sqrt{a^2 - x^2}} = \sin^{-1}\left(\frac{x}{a}\right) + c \) with proof.

3. \( \int \frac{dx}{\sqrt{a^2 + x^2}} = \sinh^{-1}\left(\frac{x}{a}\right) + c \)

4. \( \int \frac{dx}{x^2 - a^2} = \frac{1}{2a} \log\left(\frac{x-a}{x+a}\right) + c \) if \( x > a > 0 \).

5. \( \int \frac{dx}{a^2 - x^2} = \frac{1}{2a} \log\left(\frac{a+x}{a-x}\right) + c \) if \( a > x > 0 \).

6. \( \int \frac{dx}{\sqrt{x^2 - a^2}} = \cosh^{-1}\left(\frac{x}{a}\right) + c \)

7. \( \int \frac{dx}{x\sqrt{x^2 - a^2}} = \frac{1}{a} \sec^{-1}\left(\frac{x}{a}\right) + c \) (3 to 7 no proof)

Integrals of the forms:

\[
\int \frac{dx}{ax^2 + bx + c}, \int \frac{dx}{\sqrt{ax^2 + bx + c}}, \int \frac{px + q}{ax^2 + bx + c} \, dx, \int \frac{px + q}{\sqrt{ax^2 + bx + c}} \, dx.
\]

Problems.

Integration by parts. Rule of integration by parts. Problems.

Integration of the forms: \( \int e^x (f(x) + f'(x)) \, dx \) Problems.

**UNIT – 5: DEFINITE INTEGRALS.** 4 Hr.

Definition of Definite integral. Theorems on definite integrals. Problems.

Definite integrals of the type \( \int_0^{\pi/2} \frac{1}{1 + \tan x} \, dx, \int_0^{\pi/2} \frac{1}{1 + \sqrt{\tan x}} \, dx \) Problems.

**UNIT – 6: APPLICATIONS OF DEFINITE INTEGRALS.** 2 Hr.

Find area, volume and r m s value of a function. Problems.

**UNIT – 7: DIFFERENTIAL EQUATIONS.** 12 Hr.

Definition, example, order and degree of differential equation with examples. Formation of differential equation by eliminating arbitrary constants up to second order. Solution of D E of first degree and first order by variable separable method. Solution of differential equations reducible to variable separable form. Linear equations and its solution. Solution of differential equations reducible to linear form - Bernoulli’s form. Homogeneous form and its solution. Solution of differential equations reducible to homogeneous form. Exact differential equation and its solution. Solutions of differential equation of a type \( a \frac{d^2 y}{dx^2} + b \frac{dy}{dx} + cy = 0 \), where \( a, b, c \) are constants. Simple problems.
GENERAL AND SPECIFIC OBJECTIVES

UNIT – 1: LIMITS.  

GENERAL OBJECTIVES.

1.1 To understand variables, constants and functions.
1.2 To know the indeterminant form and evaluation of limit of a given function.

SPECIFIC OBJECTIVES.

1.1.1 Explain calculus as calculation of Infinitesimal values.
1.1.2 Define Independent, dependent variable and constants with examples.
1.1.3 Define a function.
1.1.4 List types of functions.
1.1.5 Define 1. Direct and inverse functions 2. Explicit and Implicit function 3.Odd and even function with examples.
1.2.1 Explain the concept of x tends ‘a’.
1.2.2 Define limit of a function.
1.2.3 Solve problems on limit of a function by factorization.
1.2.4 Solve problems on limit of a function by rationalization.
1.2.5 Solve problems on limit of a function when x tends INFINITY.
1.2.6 Deduce $\lim_{n \to 0} \theta = 0$ where $\theta$ is in radians
1.2.7 Solve problems on above results.
1.2.8. Write formula for standard limits(statement only).

UNIT – 2: DIFFERENTIAL CALCULUS.

GENERAL OBJECTIVES.

2.1 To understand the differentiation of a function in terms of limit of a function.
2.2 To know different methods of differentiation.
2.3 To know the derivatives of higher order up to second order.

SPECIFIC OBJECTIVES.
2.1.1 Define increment and increment ratio.
2.1.2 Define differentiation.
2.1.3 Derive the differential co-efficient (dy/dx).
2.1.4 Derive differentiation of a functions from first principle method \( x^n \), Sinx, Cosx and Tanx with respect to ‘x’.
2.1.5 State derivative of \( e^x \) and \( \log x \).
2.2.1 State rules of differentiation: Derivatives of Sum, Product and quotient of function.
2.2.2 Solve problems on rules of differentiation.
2.2.3 Obtain the derivatives of function of a function (Chain Rule), Inverse T-functions, Implicit functions & Parametric functions
2.2.4 Solve problems on above types.
2.2.5 Carry out logarithmic Differentiation
2.2.6 Solve problem of the type \( x^x \), \( a^x \), \( x^{\sin x} \), \( x^{1/x} \) etc.,
2.3.1 Obtain the second derivative of a function.
2.3.2 Solve problems on Successive differentiation.

UNIT -3: APPLICATIONS OF DIFFERENTIATION. 6Hr.

GENERAL OBJECTIVES.

3.1 To understand \( \frac{dy}{dx} \) as slope of a tangent.
3.2 To illustrate \( \frac{dy}{dx} \) as a rate measure.
3.3 To understand maxima and minima of a function.

SPECIFIC OBJECTIVES.

3.1.1 Explain geometrical meaning \( \frac{dy}{dx} \) as a slope of tangent.
3.1.2 Find equation of tangent and normal to a curve \( y = f(x) \) at a given point.
3.1.3 Solve problems on tangent and normals.
3.2.1 Explain derivative as a rate measure.
3.2.2 Obtain velocity and acceleration for a moving body whose equation of motion is given.
3.2.3 Solve problems on rate measure including variation of area, volume etc.,
3.3.1 Define increasing and decreasing function.
3.3.2 State the condition for maxima and minima of a function, no proof.
3.3.3 Find maximum and minimum values of a function.

UNIT – 4: INTEGRAL CALCULUS. 14 Hr.

GENERAL OBJECTIVES.

4.1 To know integration as converse process of differentiation.
4.2 To understand indefinite integral.

SPECIFIC OBJECTIVES.

4.1.1 Define integration as anti derivative.
4.1.2 List of standard integrals.
4.1.3 State rules of Integration.
4.1.4 Solve the problems on rules of integration.

4.2.1 Explain integration by substitution method.

4.2.2 Solve problems on substitution method.

4.2.3 Derive

$$
\int \frac{dx}{x^2 + a^2} = \frac{1}{a} \tan^{-1}\left(\frac{x}{a}\right) + c
$$

$$
\int \frac{dx}{\sqrt{a^2 - x^2}} = \sin^{-1}\left(\frac{x}{a}\right) + c
$$

4.2.4 Write

$$
\int \frac{dx}{\sqrt{a^2 + x^2}} = \sinh^{-1}\left(\frac{x}{a}\right) + c
$$

$$
\int \frac{dx}{x^2 - a^2} = \frac{1}{2a} \log\left(\frac{x - a}{x + a}\right) + c \text{ if } x > a > 0.
$$

$$
\int \frac{dx}{a^2 - x^2} = \frac{1}{2a} \log\left(\frac{a + x}{a - x}\right) + c \text{ if } a > x > 0.
$$

$$
\int \frac{dx}{\sqrt{x^2 - a^2}} = \cosh^{-1}\left(\frac{x}{a}\right) + c
$$

4.2.5 Solve problems on above results.

4.2.4 Write

$$
\int \frac{dx}{ax^2 + bx + c}, \int \frac{dx}{\sqrt{ax^2 + bx + c}}, \int \frac{px + q}{ax^2 + bx + c} dx, \int \frac{px + q}{\sqrt{ax^2 + bx + c}} dx.
$$

4.2.5 Solve problems on above results.

4.2.6 Explain the rule integration by parts.

4.2.7 Solve problems of the type $x \sin x, x^2 \cos x, (ax + b) e^x, x \sin^2 x, \log x, e^x \sin x, x \log x$ etc.,

4.2.8 Solve problems of the type $\int e^x (f(x) + f'(x)) dx$

**UNIT – 5: DEFINITE INTEGRALS.**

4 Hr.

**GENERAL OBJECTIVES.**

5.1 To understand the concept of definite integral to eliminate constant of integration.

**SPECIFIC OBJECTIVES.**

5.1.1 State, $\int f(x) dx$ as a definite integral.

5.1.2 State theorems on definite integrals.

5.1.3 Solve the problems of the same type as in indefinite integral using limits of integration.

5.1.4 Solve definite integrals of the type

$$
\int_{0}^{\pi} \frac{1}{1 + \tan x} dx, \int_{0}^{\pi} \frac{1}{1 + \sqrt{\tan x}} dx
$$

**UNIT – 6: APPLICATIONS OF DEFINITE INTEGRALS.**

2 Hr.

**GENERAL OBJECTIVES.**
6.1 To understand definite integral as a tool to find area under the curve, volume of solid of revolution and r m s value of a function.

SPECIFIC OBJECTIVES.

6.1.1 Explain definite integral as a limit of sum (statement).
6.1.2 Write the formulae for finding area, volume and r m s value of a function.
6.1.3 Solve problems on above applications.

UNIT – 7: DIFFERENTIAL EQUATIONS. 12 Hr.

GENERAL OBJECTIVES.

7.1 To understand the concept of differential equation.
7.2 To solve differential equation for unknown functions.

SPECIFIC OBJECTIVES.

7.1.1 Define differential equation with examples.
7.1.2 Define Order and Degree of D E with examples.
7.1.3 Formation of D E by eliminating arbitrary constants.
7.2.1 Obtain the solution of D E by variable separable method.
7.2.2 Solve problems on variable separable method.
7.2.3 Obtain the solution of D E by Reducible to variable separable method – Solve problems.
7.2.4 Obtain the solution of linear D E of the type \( \frac{dy}{dx} + Py = Q \) --solve problems.
7.2.5 Obtain the solution of D E by Reducible to linear form (Bernoulli’s form) –solve problems.
7.2.6 Obtain the solution of D E by Homogeneous form – solve problems.
7.2.7 Obtain the solution of D E by Reducible to homogeneous form – solve problems.
7.2.8 Obtain the solution of Exact D E --- solve problems.
7.2.9 Obtain the solution of D E of the type \( a \frac{d^2y}{dx^2} + b \frac{dy}{dx} + cy = 0 \), -- Solve simple problems only.

*************************************************
BOARD OF TECHNICAL EXAMINATION – KARANATAKA

MODEL QUESTION PAPER

Code:

APPLIED MATHEMATICS –II ( FOR ALL COURSES)

Time: 3 Hrs
Maximum marks:100

NOTE:  i) Answer any 10 questions in section A, 7 questions in section B
5 questions in section C, & 4 questions in D

ii) Each question carries 2 marks in section A

iii) Each question carries 5 marks in remaining section

SECTION – A

1. Evaluate \( \lim_{x \to 0} \frac{\sin^2 3x}{\tan^2 4x} \)

2. Evaluate \( \lim_{x \to 2} \frac{x^3 - 8}{x^4 - 16} \)

3. Find \( \frac{dy}{dx} \) if \( y = 1 - \cos 4x \)

4. Find \( \frac{dy}{dx} \) if \( x^2 + y^2 = a^2 \)

5. Find \( \frac{dy}{dx} \) if \( x = \sin \theta \) and \( y = \cos \theta \)

6. Find the slope of a tangent to the curve \( y = x^2 + 6x – 7 \) at point \( (1, -2) \)

7. If \( s = 4t^2 - 4t + 6 \) then find velocity when \( t = 2 \) second

8. Evaluate \( \int e^x \tan e^x \, dx \)

9. Evaluate \( \int \sin^2 x \, dx \)

10 Evaluate \( \int \cos ec(1 - 4x) \, dx \)

11. Evaluate \( \int_{0}^{4} \frac{1}{\sqrt{x}} \, dx \)

12. Evaluate \( \int_{0}^{\pi/2} \sin x \, dx \)
13. Evaluate \( \int_{0}^{\pi/2} \tan^2 x \, dx \)

14. Evaluate \( \int \frac{\sin x}{\cos^2 x} \, dx \)

15. Show that \( \frac{d(a^x)}{dx} = a^x \log_e a \)

**SECTION – B**

1. Prove geometrically \( \lim_{\theta \to 0} \frac{\sin \theta}{\theta} \)

2. Evaluate \( \lim_{x \to 0} \frac{3\sin 2x - 5x}{4x - \tan x} \left( \frac{dy}{dx} + 1 \right) = e^x \)

3. Find the derivative of \( \tan x \) w.r.to \( x \) form the first principle

4. If \( y = e^x (\sin x - \cos x) \), find \( \frac{dy}{dx} \).

5. If \( y = \frac{2 + 3 \sinh x}{3 + 2 \cosh x} \), find \( \frac{dy}{dx} \)

6. If \( x\cos y + y\sin(x/y) = k \) find \( \frac{dy}{dx} \).

7. Find \( \frac{dy}{dx} \) if \( x = a(\cos \theta + \theta) \) and \( y = a(1 - \sin \theta) \)

8. If \( y = \sin x \cos x \), find \( \frac{dy}{dx} \).

9. Find the equations of tangent and normal to the curve \( y^2 = 9x \) at \( (1, -3) \)

10. Find the maximum and minimum value of the function \( 2x^3 - 12 x^2 + 18x + 5 \).

**SECTION – C**

1. Evaluate \( \int \sin^3 x \, dx \)

2. Evaluate \( \int \frac{dx}{x^2 - 6x + 13} \)

3. Evaluate \( \int x^2 \sin x \, dx \)

4. Evaluate \( \int \frac{2x + 3}{\sqrt{8 - 2x - x^2}} \, dx \)

5. Evaluate \( \int_{0}^{\pi/2} \cos^3 x \, dx \)
6. Evaluate \( \int x \log x \, dx \)

7. Evaluate \( \int \frac{x^4}{x^7 + 1} \, dx \)

8. Find the area bounded by the curve \( y = 4x - x^2 - 3 \) and x-axis.

**SECTION – D**

Solve the following equations;

1. \( \sec^2 x \tan y \, dx + \sec^2 y \tan x \, dy = 0 \)
2. \( y (1 + x) \, dx + x (1 + y) \, dy = 0 \)
3. \( (y^3 - 3x^2y) \, dx - (x^3 - 3xy^2) \, dy = 0 \)
4. \( (3y - 7x + 7) \, dx + (7y - 3x + 3) \, dy = 0 \)
5. \( (2x + y + 1) \, dx + (x + 2y + 1) \, dy = 0 \)
6. \( e^y \left( \frac{dy}{dx} + 1 \right) = e^x \)
Diploma Course in Mechanical Engineering (Welding & Sheet Metal Engg.)
Second Semester
Subject: Workshop Practice (Carpentry & Fitting)
Contact Hrs / week : 9
Contact Hrs / Semester: 1

Graded Excercises

Carpentry
1. Draw the layout of carpentry shop
2. Sketch carpentry tools
3. State brief description and use of carpentry tools
4. Mark for operations like sawing, planing, chiseling and wood turning
5. State safety precautions for the above operations
6. Prepare the following carpentry joints
   6.1 Half lap joint
   6.2 Mortise and Tenon joint
   6.3 Dovetail joint
   6.4 Bridle joint
7. Prepare utility articles like coat-hanger, shoe-rack, book-shelf
8. Measure quantity of wood required for a given task (with respect to items mentioned in serial no 7)
9. Prepare at least 5 to 6 wooden models using Power Tools

Fitting
1. Draw the layout of fitting shop
2. Sketch fitting tools
3. State brief description and use of fitting tools
4. Mark for operations like chipping, filing, drilling, cutting and tapping
5. State safety precautions for the above operations
6. Prepare the following fitting models
   6.1 Chipping of step block and V block
   6.2 Filing of step block and V block
   6.3 Reducing round section into square section by chipping and filing
   6.4 Making of male and female gauges with V joint, rectangular joint and semi circular joint
7. Prepare utility articles like screw drivers, hinges, hexagonal nut
8. Measure quantity of metal required for a given task (with respect to items mentioned in serial no 7)

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ENGINEERING MECHANICS & STRENGTH OF MATERIALS

Subject Title : Engineering Mechanics & Strength of Materials.
Subject Code :
Hours Per Week : 04
Hours Per Semester : 64

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OBJECTIVES

On completion of the course the students should be able to...

2. Understand the force analysis.
3. Understand the concept of centre of gravity & moment of inertia.
4. Understand the concept of simple stresses & strains.
5. Understand the concept of bending moment & shear force diagrams.
6. Understand strain energy & impact loading.
7. Understand the concept of bending & torsion.
8. Understand the concept of thick & thin cylinders.

COURSE CONTENTS

1.0 INTRODUCTION TO ENGINEERING MECHANICS
1.1 Introduction to Engineering Mechanics.
1.2 Statics, Dynamics, Kinetics & Kinematics.
1.3 Scalar & Vector quantities.
2.0 FORCE ANALYSIS
2.1 Composition & Resolution of forces – Force, effect, characteristics of a force, system of forces, resultant force, methods for the resultant force and simple problems.
2.2 Parallelogram law of forces and simple problems.
2.3 Triangle law of forces
2.4 Polygon law of forces
2.5 Moments & their applications – Moments of a force, types of moments, law of moments, applications of moments - levers, types of levers.
2.6 Parallel force & couples – Classification of parallel forces, analytical method for the resultant of parallel forces and simple problems.
2.7 Couple – Moment of a couple and classification of couples.
2.8 Equilibrium of forces – Introduction, principles of equilibrium, lami’s theorem, types of equilibrium.

3.0 CENTRE OF GRAVITY & MOMENT OF INERTIA
3.1 Centre of gravity, methods of finding centre of gravity and axis of reference.
3.2 Centre of gravity of symmetrical & unsymmetrical plane figures.
3.3 Simple problems.
3.4 Moment of inertia, units of moment of inertia.
3.5 Moment of inertia of a plane area.
3.6 Methods for moment of inertia.
3.7 Moment of inertia of triangular, rectangular, circular & hollow circular sections.
3.8 Simple problems.
3.8 Theorem of parallel axis and Theorem of perpendicular axis.
3.9 Moment of inertia of L, I, T sections.
3.10 Simple problems.

4.0 SIMPLE STRESSES & STRAINS
4.1 Elasticity, stress, types of stress, strain.
4.2 Elastic limit, Hooke’s law & modulus of elasticity.
4.3 Deformation of a body due to force acting on it.
4.4 Simple problems.
4.5 Temperature stresses in simple bars.
4.6 Elastic constants, linear strain, lateral strain, volumetric strain & Poisson’s ratio.
4.7 Bulk modulus, relation between bulk modulus & young’s modulus (without proof).
4.8 Shear stress, shear strain & modulus of rigidity.
4.9 Relation between modulus of elasticity & modulus of rigidity (without proof).
4.10 Simple problems.

5.0 BENDING MOMENT AND SHEAR FORCES
5.1 Introduction, types of loading.
5.2 Shear force and bending moment.
5.3 Sign conventions.
5.4 Shear force and bending moment diagrams.
5.5 Shear force and bending moment diagrams for cantilever, simply supported beams subjected to point load & uniformly distributed load.

6.0 STRAIN ENERGY & IMPACT LOADING
6.1 Introduction, resilience, proof resilience and modulus of resilience.
6.2 Types of loading.
6.3 Equation for strain energy stored in a body when the load is gradually applied.
6.4 Simple problems.
6.5 Equation for strain energy stored in a body when the load is suddenly applied.
6.6 Simple problems.

7.0 THEORY OF SIMPLE BENDING & THEORY OF TORSION
7.1 Introduction, assumptions in theory of simple bending.
7.2 Bending stress, relation between bending stress & radius of curvature (without proof).
7.3 Position of neutral axis, moment of resistance.
7.4 Bending equation (without proof).
7.5 Modulus of section for rectangular, hollow rectangular and hollow circular sections.
7.6 Simple problems.
7.7 Theory of torsion, assumptions and polar moment of inertia.
7.8 Power transmitted by a shaft.
7.9 Torsional rigidity equation (without proof).
7.10 Simple problems.

8.0 THICK AND THIN CYLINDERS
8.1 Introduction to thin cylinders, stresses in thin cylindrical shells.
8.2 Expression for circumferential stress & longitudinal stresses (without proof).
8.3 Simple problems.
8.4 Design of thin cylinders with simple problems.
8.5 Thick cylinders, assumptions Lame’s theory.
8.6 Equation of Lame’s theory (without proof).
8.7 Simple problems.

SPECIFIC INSTRUCTIONAL OBJECTIVES

1.0 Introduction to engineering mechanics
1.1 Explain the importance of engineering mechanics.
1.2 Define the various branches of engineering mechanics.
1.3 Define statics, dynamics, kinetics and kinematics.
1.4 Explain scalar and vector quantities with examples.

2.0 Force analysis
2.1 Define force
2.2 List effects of a force
2.3 List characteristics of a force.
2.4 Explain the system of forces
2.5 Define resultant force.
2.6 State the methods for the resultant force.
2.7 State parallelogram law of forces and solve simple problems.
2.8 State the principle of resolution
2.9 Explain the method of resolution for the resultant force and solve simple problems.
2.10 State triangle law of forces and polygon law of forces.
2.11 Define moment of a force.
2.12 State types of moments – clockwise and anticlockwise moments.
2.13 State law of moments
2.14 Define a lever.
2.15 List the types of levers.
2.16 Explain the concept of parallel forces and give classification of parallel forces – like and unlike parallel forces.
2.17 Analytical method for the resultant of parallel forces and simple problems.
2.18 Define a couple, Explain moment of a couple, and classify couple – clockwise and anticlockwise moments.
2.19 Explain equilibrium of forces.
2.20 State principles of equilibrium.
2.21 State Lami’s theorem (without proof).
2.22 Explain types of equilibrium – stable, unstable and neutral equilibrium.

3.0 Centre of gravity & moment of inertia
3.1 Define centroid and list methods for finding centroid.
3.2 Explain axis of reference.
3.3 Explain centre of gravity of plane figures and solve simple problems on finding centre of gravity of symmetrical & unsymmetrical sections.
3.4 Define moment of inertia and mention the units of moment of inertia.
3.5 Explain the moment of inertia of a plane area.
3.6 State methods for moment of inertia – Routh’s rule & Integration method.
3.7 Explain the moment of inertia by Integration method.
3.8 Mention the equation of moment of inertia of triangular, rectangular, circular and hollow circular sections and solve simple problems.
3.9 State theorem of parallel axes and theorem of perpendicular axes (without proof).
3.10 Solve simple problems on finding moment of inertia of L, I & T sections.

4.0 Simple stresses & strains
4.1 Define elasticity, stress, and strain.
4.2 Explain types of stresses – tensile, compressive stress.
4.3 Define elastic limit, state Hooke’s law and explain modulus of elasticity.
4.4 State the equation for deformation of a body due to force acting on it.
4.5 Solve simple problems on finding deformation, modulus of elasticity and diameter of a given component.
4.6 Explain temperature stresses in simple bars.
4.7 Explain elastic constants – linear strain, lateral strain, volumetric strain and Poisson’s ratio.
4.8 simple problems.
4.9 Define bulk modulus and state the relation between bulk modulus and young’s modulus (without proof).
4.10 Simple problems.
4.11 Explain shear stress, shear strain and modulus of rigidity.
4.12 State relation between modulus of elasticity and modulus of rigidity (without proof)
4.13 Simple problems.

5.0 Bending moment & shear forces
5.1 Explain types of loading – point load, uniformly distributed load and uniformly varying load.
5.2 Define shear force and bending moment.
5.3 Explain sign conventions for shear force and bending moment.
5.4 Explain shear force and bending moment diagrams.
5.5 Solve simple problems on calculating shear force and bending moment for cantilever, simply supported beams subjected to point load and uniformly distributed load with shear force and bending moment diagrams.

6.0 Strain energy & impact loading
6.1 Explain strain energy.
6.2 Define resilience, proof resilience and modulus of resilience.
6.3 Explain types of loading – gradually applied load and suddenly applied load.
6.4 State the equation for strain energy stored in body when the load is gradually applied. and solve simple problems.

6.5 State the equation for strain energy stored in a body when the load is suddenly applied.

7.0 Theory of simple bending & Theory of torsion

7.1 Explain bending stress and list the assumptions in theory of simple bending.
7.2 State relation between bending stress and radius of curvature (without proof).
7.3 Explain position of neutral axis and moment of resistance.
7.4 State bending equation (without proof).
7.5 Explain modulus of section.
7.6 State equation for modulus of section of rectangular, hollow rectangular, circular and hollow circular sections.
7.7 Solve simple problems on above sections only using bending equation.
7.8 Explain torsion and state assumptions for shear stress in a circular shaft subjected to torsion.
7.9 Explain polar moment of inertia.
7.10 State torsion equation (without proof).
7.11 State the equation for power transmitted by a shaft.
7.12 State the equation for torque transmitted by solid shaft and hollow shaft.
7.13 Solve simple problems on solid and hollow circular shafts considering above equations only.

8.0 Thick and Thin cylinders

8.1 Explain the concept of thin cylindrical shells.
8.2 State the stresses in thin cylindrical shell – circumferential and longitudinal stress.
8.3 State the equation for circumferential and longitudinal stress.
8.4 Solve simple problems on above.
8.5 State the equation for thickness of thin cylindrical shells and solve simple problems.
8.6 Explain the concept of thick cylindrical shells
8.7 State assumptions of lame’s theory.
8.8 State equation of lame’s theory (without proof).
8.9 Solve simple problems.


REFERENCE BOOKS

DEPARTMENT OF TECHNICAL EDUCATION
DIPLOMA COURSE IN MECHANICAL ENGINEERING
THIRD SEMESTER
MODEL QUESTION PAPER
ENGINEERING MECHANICS & STRENGTH OF MATERIALS

Time: 3Hrs
Max marks: 100

Note: 1 Section-I is compulsory
2 Answer any six full questions from Section-II, Section-III, and Section-IV, Choosing at least two from each section.

SECTION- I

1 a) Fill in the blanks with appropriate words
   i) The ratio of volumetric stress to volumetric strain is called ______________.
   ii) A set of forces whose resultant is zero are called ______________.
   iii) The point through which the whole weight of the body acts irrespective of its position is known as ___
   iv) A pair of two equal & unlike parallel forces with lines of action parallel to each other & acting in opposite directions is known as ______________.
   v) The layer which is neither compressed nor stretched when the section is subjected to bending is known as ___

1X5= 5

b) State the assumptions in theory of simple bending?

SECTION-II

2 a) Define resultant force.  
   b) What are the effects of a force?
   c) A triangle ABC has its sides AB=40mm along X-axis and side BC=30mm along positive Y-axis, three forces 40N,50N & 30N along the sides AB,BC & CA respectively. Determine the magnitude of resultant of such a system of forces.

2 3 10

3 a) Define centroid
   b) State methods for determining centre of gravity.

2 3
c) Find the centroid of an unequal angle section shown in figure below

![Unequal Angle Section](image1.png)

4 a) Define moment of inertia
b) State theorem of parallel axis.
c) Find the moment of inertia of T-section shown in the figure below

![T-Section](image2.png)

5 a) Define modulus of elasticity.
b) Explain the temperature stresses.
c) In an experiment a bar of 30 mm diameter is subjected to a pull of 60 KN. The measured extension on gauge length of 200 mm is 0.09 mm and the change in diameter is 0.0039 mm. Calculate the Poisson’s ratio, rigidity modulus and bulk modulus.

6 a) Define shear force.
b) State the types of loading.
c) Draw shear force and bending moment diagrams for a cantilever beam of span 1.5m carrying point loads as shown in figure.

![Cantilever Beam](image3.png)

7 a) Define bending moment.
b) Explain sign conventions for shear force and bending moment.
c) A simply supported beam AB of span 2.5m is carrying two point loads as shown in figure. Draw the shear force and bending moment diagrams.
SECTION-IV

8  a) Define strain energy  
    b) Define i) proof resilience   ii) modulus of resilience  
    c) A rectangular beam 60mm wide and 150 mm deep is simply supported over a span of 6m. If the beam is subjected to a central point load of 12KN find the maximum bending stress induced in the beam section.  

9  a) Define polar moment of inertia  
    b) State the assumptions for shear stress in a circular shaft subjected to torsion.  
    c) A hollow shaft is to transmit 200 KW at 80 rpm. If the shear stress is not to exceed 60 MPa and internal diameter is 0.6 of external diameter. Find the diameters of the shaft.  

10  a) what is a thin cylindrical shell?  
    b) State equations for circumferential stress and longitudinal stress in a thin cylindrical shell.  
    c) A cylindrical shell of 1.3 m diameter is made up of 18mm thick plates. Find the circumferential & longitudinal stress in the [plates if the boiler is subjected to an internal pressure of 2.4 MPa. Take efficiency of the joints as 20%.
MANUFACTURING TECHNOLOGY – I

Subject Title : Manufacturing Technology – I (WSM)
Subject Code : W
Hours Per Week : 04      Hours Per Semester : 64

TOPIC ANALYSIS

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General Objectives:

On completion of the course the students should be able to:
1. Understand the various materials used in manufacturing of the products.
2. Understand the metal casting techniques used in manufacturing
3. Understand the concepts of forging, its types & importance in manufacturing
4. Understand the various mechanical working processes of metals
5. Understand the basic working of lathe, its operations & applications
6. Understand the basic working of drilling machines, its operations & applications
7. Understand milling machines, their construction, operations, indexing methods & milling cutters.
8. Understand the importance & purpose of cutting fluids & coolants & their types & uses.

CONTENTS:

1.0 Materials for manufacturing
   1.1 Manufacturing
   1.2 Ferrous and non-ferrous materials.
   1.3 Heat treatment
   1.4 Carbon Equilibrium diagram
   1.5 Review of heat treatment processes
   1.6 Advanced materials used in manufacturing
   1.7 Ceramics
   1.8 Polymers
2.0 Metal casting process
2.1 Introduction to metal casting
2.2 Casting: steps involved in casting
2.3 Pattern for casting
2.4 Pattern making materials
2.5 Pattern Types & allowances
2.6 Moulding- Moulding sands-Moulding process
2.7 Special casting processes - Die casting, Centrifugal casting & Investment casting.
2.8 Defects in casting and their remedies

3.0 Forging
3.1 Introduction
3.2 Presses & Hammers
3.3 Forging Processes
3.4 Forging operations
3.5 Defects in forging and their remedies

4.0 Mechanical working of metals
4.1 Introduction
4.2 Comparison of cold working and hot working
4.3 Rolling-Types of rolling mills
4.4 Hot working-Advantages and limitations
4.5 Cold working-Advantages and limitations, Types of cold working process

5.0 Lathe
5.1 Introduction to lathe.
5.2 Classification of lathes -specification of lathe
5.3 Constructional features of Engine lathe
5.4 Lathe attachments, accessories & work holding devices
5.5 Lathe operations
5.6 Taper turning and thread cutting.
5.7 Machining parameters-cutting speed, feed, depth of cut and machining time
5.8 Capstan and Turret lathe-Description-comparison with engine lathes

6.0 Drilling machine
6.1 Introduction
6.2 Classification of drilling machines
6.3 Radial drilling machine-working-drilling operations
6.4 Twist drill nomenclature
6.5 Machining parameters-cutting speed, feed, depth of cut and machining time

7.0 Milling machine
7.1 Introduction to milling and classification.
7.2 Column and knee type milling machine & copy milling machine.
7.3 Milling cutters and classification.
7.4 Fundamentals of milling processes
7.5 Milling machine operations.
7.6 Indexing methods.
7.7 Cutting speed, feed, depth of cut and machining time.
7.8 Gear hobbing

8.0 Cutting fluids and Coolants
8.1 Introduction.
8.2 Purpose and Properties.
8.3 Coolants and lubricants for different operations.
SPECIFIC INSTRUCTIONAL OBJECTIVES

1.0 MATERIALS FOR MANUFACTURING
1.1 Define Manufacturing
1.2 List the different ferrous & non ferrous materials used in manufacturing & Applications.
1.3 State the purpose of heat treatment
1.4 Explain Iron carbon equilibrium diagram
1.5 Review the heat treatment process
1.6 List the advanced materials used in manufacturing.
1.7 State the general properties and applications of ceramic materials
1.8 State the general properties and applications of polymers
1.9 Explain Thermo plastic and Thermo setting plastics
1.10 State the general properties and applications of composite materials

2.0 METAL CASTING PROCESS
2.1 Explain Casting
2.2 Explain the basic steps involved in casting process
2.3 Define pattern and explain its importance in metal casting
2.4 List the different pattern making materials
2.5 Explain the different pattern making allowances
2.6 Describe briefly different types of patterns
2.7 Explain molding
2.8 List the different types of sands involved in molding process
2.9 Explain the Molding processes - Sand molding, Pit molding, machine molding & Shell molding.
2.10 Explain the Special casting processes - die casting, centrifugal casting & Investment casting.
2.11 State the defects in casting

3.0 FORGING
3.1 Explain the importance of forging.
3.2 List the different types of Presses and hammers in forging
3.3 Explain forging process - Drop forging, Upset forging, Die forging & press forging.
3.4 Explain Forging operations- Closed die Forging operation, Fullering, Edging, Bending, Blocking & Finishing.
3.5 List the Forging defects and its remedies.

4.0 MECHANICAL WORKING OF METALS
4.1 Explain mechanical working of metals.
4.2 Differentiate cold working with hot working.
4.3 Sketch and describe the working principle of rolling,
4.4 Explain briefly the rolling mills- Two high, Three high, Four high, Universal & Planetary rolling mills
4.5 State advantages and limitations of hot working.
4.6 List various cold working processes
4.7 State advantages and limitations of cold working.

5.0 LATHE
5.1 Explain about lathe
5.2 List the different types of lathe with classification
5.3 Specify the size of a lathe
5.4 Draw the line diagram of the lathe, label its parts & brief working of lathe
5.4 List the lathe attachments, accessories & work holding devices
5.5 Explain various operations performed in lathe-turning, taper turning, knurling & thread cutting
5.6 Explain thread cutting procedure.
5.7 Define cutting speed, feed, depth of cut and machining time
5.8 Explain Capstan and Turret lathe with sketch & Identify difference between them.
5.9 Compare Capstan / Turret and Engine lathe.
5.10 Simple problems.

6.0 DRILLING MACHINE
6.1 Introduction
6.2 List out different types of drilling machines.
6.3 Explain different parts of radial drilling machine with sketch
6.4 Explain different operations performed in a drilling machine- drilling, reaming, tapping, counter boring & counter sinking.
6.5 Draw a twist drill & label its parts
6.6 Define cutting speed, feed, depth of cut and machining time.
6.7 Simple problems.

7.0 Milling machine
7.1 Introduction to milling and classification of milling machines.
7.2 Sketch & Explain – 1) Column & Knee Type Milling Machine  2) Copy Milling machine
7.3 Explain the standard milling cutters & classify the milling cutters.
7.4 Sketch & Explain Up Milling & Down Milling
7.5 Explain different Milling machine operations – plain , end , slot , T , gear cutting, grooves & Splines.
7.6 Explain Direct, Simple, angular & Compound Indexing.
7.7 Define Cutting speed, feed, depth of cut and machining time
7.8 Explain Gear Hobbing
7.9 Simple problems on above Indexing methods

8.0 Cutting fluids and Coolants
8.1 Explain importance of cutting fluids and coolants.
8.2 Explain purpose and Properties.
8.3 Applications of Coolants and lubricants for different operations.
8.4 Name different cutting fluids & coolants.

REFERENCE BOOKS:
1) Workshop Technology by Hazara choudary VOL - I & VOL – II.
2) Production Technology by Dr.P.C.Sharma., S Chand & Co
3) Workshop technology by B.S.Raghuwamshi
5) Production Technology by R.K.Jain.
6) Manufacturing Technology I & II , Dr P C Sharma , S Chand & Co
7) Manufacturing Technology - P P Date , Jaico Publishing House
MODEL QUESTION PAPER
SUBJECT : MANUFACTURING TECHNOLOGY – I
SUBJECT CODE :_______
TIME : THREE HOURS
TOTAL MARKS : 100

Note : 1) Section – I is compulsory.
2) Answer any TWO FULL QUESTIONS FROM SECTION – II, III & IV
3) Each Full Question in Section II, III & IV carries FIFTEEN MARKS
4) Marks are indicated for questions at right side.

SECTION – I
Q – I ) a) Fill in the blanks with appropriate words 5X1= 5
i) _________ gas is used in Metal Inert gas welding.
ii) Draft allowance is allowed in ___________ making.
iii) ___________ invented the engine lathe.
iv) ____________ attachment is used for taper turning in lathe.
v) With the help of _________ treatment metals acquire desired properties.

b) State any five manufacturing processes with applications 05

SECTION – II
Q – II ) a) State the importance of metal casting. 03
b) Indicate five casting defects & give remedies for each 05
c) Explain with neat sketch the Centrifugal Casting process 07

Q – III ) a) Mention the differences between Open Die & Closed Die forging 05
b) List at least five forging defects & their remedies 05
c) Explain with neat sketch DIE FORGING 05

Q- IV ) a) State five general properties & applications of Composite materials 05
b) Explain five pattern making allowances 05
c) Explain FULLERING with a suitable sketch 05

SECTION – III
Q – V ) a) Explain with neat sketch TIG welding process 06
b) Sketch the POWER PRESS & label its parts 05
c) List the defects in welding 04

Q- VI ) a) Describe the working principle of Rolling with a neat sketch 06
b) Describe any one die accessories with neat sketch 05
c) With a suitable sketch explain Three high rolling mill 04

Q- VII ) a) Explain with neat sketch spot welding 05
b) Define any five press operations 05
c) Mention the advantages & limitations of hot working 05
SECTION – IV

Q – VIII ) a) How do you specify the lathe 05
   b) Draw a twist drill & label its parts clearly 05
   c) Explain briefly the thread cutting procedure on the lathe 05

Q- IX ) a) With a neat sketch explain taper turning by taper turning attachment. 06
   b) Sketch & label all the parts of Radial Drilling Machine 05
   c) Explain the knurling operation 04

Q- X ) a) With suitable notations define:
   i) Cutting Speed  ii) Feed  iii ) Depth of Cut 06
   b) With simple sketches briefly explain:
      i) Reaming  ii ) Tapping 06
   c) Define machining time & mention its units 03
MECHANICAL MEASUREMENTS AND METROLOGY

Subject Title : Mechanical measurements and metrology
Subject Code  : M-
Hours Per Week : 04
Hours Per Semester : 64

TOPIC ANALYSIS

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<td>Transducers and strain gauges</td>
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OBJECTIVES

On the completion of the course the students should be able to:

1. Understand the principle of operation and calibration of an instrument.
2. Know different measuring device for a particular application.
3. Understanding the concepts of limits, fits and tolerance
4. Understand various testing tools for checking the alignment of machine tools
5. Understand the various transducers and application of strain gauges
6. Understand the different devices used to measure force, torque, and pressure
7. Understand the different devices used to measure Speed, Flow, and Temperature
8. Understand the different devices used to measure density, humidity, blood pressure

COURSE CONTENTS

1.0 Introduction to measurements
   1.1 Definition of measurement
   1.2 Significance of measurement,
   1.4 Methods of measurements
   1.5 Generalized measuring system
   1.3 Standards of measurements.
   1.6 Factors in selecting the measuring instruments
1.7 Terms applicable to measuring instruments: Precision and Accuracy, Sensitivity and Repeatability, Range, Threshold, Hysteresis, calibration
1.8 Errors in Measurements: Classification of errors, Systematic and Random error.

2.0 Measuring instruments
2.1 Introduction
2.2 Thread measurements: Thread gauge micrometer
2.3 Angle measurements: Bevel protractor, Sine Bar,
2.4 Gauges: plain plug gauge, ring Gauge, snap gauge, limit gauge
2.5 Comparators: Characteristics of comparators, Types of comparators
2.6 Surface finish -Definition, Terminology of surface finish
   Talysurf surface roughness tester
2.7 Co-ordinating measuring machine

3.0 Limits, Fits, Tolerances
3.1 Limit: Maximum limit, Minimum limit, Basic size, Nominal size
3.2 Fit: Types of fits-Hole basis and Shaft basis system
3.3 Tolerance: Basic terminology, unilatrel and bilateral tolerance
3.4 Interchangability and selective assembly

4.0 Machine tool metrology
4.1 Testing instruments for machine tools alignment testing
4.2 Checking Parallelism, Straightness, runout, alignment testing of machine tool as per IS standard procedure.

5.0 Transducers and Strain gauges
5.1 Introduction.
5.2 Transducers: Characteristics, classification of transducers, two coil self inductance transducer, Piezoelectric transducer
5.3 Strain Measurements: Strain gauge, Classification, mounting of strain gauges, Strain gauge rosettes-two and three elements

6.0 Measurement of force, torque, and pressure
6.1 Introduction.
6.2 Force measurements: Spring Balance, Proving ring, Load cell
6.3 Torque measurement: Prony brake, Hydraulic dynamometer
6.4 Pressure measurement: Mcloed gauge,

7.0 Applied mechanical measurements
7.1 Speed measurement- Classification of tachometers, Revolution counters Eddy current tachometers
7.2 Displacement measurement- Linear variable Differential transformers (LVDT),
7.3 Flow measurement-Rotometers,
7.4 Temperature measurement- Resistance thermometers, Optical Pyrometer.

8.0 Miscellaneous measurements
8.1 Humidity measurement –hair hygrometer,
8.2 Density measurement-hydrometer,
8.3 Liquid level measurement —sight glass, Float gauge
8.4 Biomedical measurement-Sphygmo monometer
SPECIFIC INSTRUCTIONAL OBJECTIVES

1.0 INTRODUCTION TO MEASUREMENTS
1.1 Define measurement.
1.2 Explain the significance of measurement.
1.3 Explain direct and indirect comparison methods of measurement.
1.4 Explain with block diagram generalized measuring system.
1.5 Explain primary and secondary standards of measurements.
1.6 List the factors to be considered while selecting the instruments.
1.7 Define: Precision and Accuracy, Sensitivity and Repeatability, Reproducibility, Range, Threshold, Hysteresis, calibration with respect to measuring instruments.
1.8 Classification of errors in measuring instruments.
1.9 Explain systematic and random errors.

2.0 MEASURING INSTRUMENTS
2.1 Explain the measurement of screw threads elements using Thread gauge micrometer.
2.2 Explain the construction and working of sine bar.
2.3 Explain the construction and working of bevel protractor.
2.4 Sketch and explain: plain plug gauge, ring Gauge, snap gauge, limit gauge, feeler gauge.
2.5 Explain the characteristics of comparators.
2.6 Explain with sketch the working of mechanical comparator (Reed type).
2.7 Explain with sketch the working of Electrical comparator.
2.8 Explain with sketch the working of optical comparator.
2.9 Explain basic terms of surface finish.
2.10 Explain the measurement of surface finish by Talysurf surface roughness tester.
2.11 Explain the role of co ordinate measuring machines (CMM).

3.0 LIMITS, FITS, TOLERANCES
3.1 Outline the importance of concepts of limits and tolerance.
3.2 Explain different types of fits-Clearance, transistion, interference.
3.3 Explain unilateral and bilateral tolerance.
3.4 Explain hole basis and shaft basis system.
3.5 Explain Interchangability and selective assembly.

4.0 MACHINE TOOL METROLOGY
4.1 List the various testing instruments for machine tools alignment testing.
4.2 Explain the checking of parallelism of spindle axis to carriage movement in lathe.
4.3 Explain the checking of straightness of the carriage movement in lathe.
4.4 Explain the checking of run out of axis of centre in lathe.
4.5 Explain the checking for the vertical straightness of knee of milling machine.

5.0 TRANSUCERS AND STRAIN GAUGES
5.1 Explain the characteristics of transducers.
5.2 State the requirement of transducers.
5.3 Outline the classification of transducers.
5.4 Explain working of two coil self inductance transducers
5.5 Explain working of Piezo electric transducers
5.6 Explain the principle of strain gauge
5.7 Explain the mounting of strain gauge
5.8 Explain with diagram two element and three element strain gauge rosettes
5.9 Explain optical strain gauge

6.0 MEASUREMENT OF FORCE, TORQUE, AND PRESSURE
6.1 Outline the concepts
6.2 Sketch and explain the spring balance
6.3 Sketch and explain the Proving ring
6.4 Explain the piezoelectric load cell
6.5 Explain measurement of torque by proney brake
6.6 Explain working of hydraulic dynamometer
6.7 Explain working of Mcloed gauge

7.0 APPLIED MECHANICAL MEASUREMENTS
7.1 Outline the classification of tachometers
7.2 Sketch and explain revolution counter
7.3 Sketch and explain Eddy current tachometer
7.4 Explain the working of LVDT
7.5 Explain the measurement of flow of liquid using rotameter
7.6 Explain the principle of working of thermo couple.
7.7 Explain working of resistance thermometer
7.8 Explain working of optical pyrometer

8.0 MISCELLANEOUS MEASUREMENTS
8.1 Explain the working of hair hygrometer
8.2 Sketch and explain hydrometer
8.3 How the level of liquid can be measured using sight glass
8.4 Explain the principle of float gauge for liquid level measurement
8.5 How the blood pressure is measured using sphygmomanometer

REFERENCES
3. “Principles of Industrial instrumentation and control systems” by Channakesava R. Alavala, DELMAR cenage learning, 2009
8. Mechanical Measurements by DOEBLIN
PART- I

1 A) Fill in the blanks with appropriate words:--  
   i) The actual difference between the true value and indicated value is _____________.  
   ii) Rosette is _____________ grid strain gauge  
   iii) __________ device is used for blood pressure measurement  
   iv) The spring balance is used for measurement of ______________.  
   v) The fluctuating experimental condition results in _______________ Error  

   B) Write a note piezoelectric transducer.  

PART-II

2 a) Define the following terms w.r.t measuring instrument  
   i) Sensitivity  ii) Hysteresis iii) Range  
   b) Explain with block diagram generalized measuring system.  
   c) Classify the errors in measuring instruments.  

3 a) Explain with sketch bevel protractor  
   b) Describe briefly the role of co ordinate measuring machines (CMM)  
   c) State the characteristics of comparators  

4 a) Sketch and explain optical comparator  
   b) Explain Transition fit and clearance fit with an example.  
   c) Differentiate between hole basis and shaft basis system  

PART-III

5 a) State various testing instruments for machine tools alignment testing  
   b) Explain with diagram checking of parallelism of spindle axis to carriage movement in lathe.  
   c) How the vertical straightness of knee of milling machine being checked.  

6 a) How are Transducers classified  
   b) Explain piezoelectric transducers  
   c) State the characteristics of transducers  

7 a) How are strain gauges classified  
   b) What are ROSSETTE gauges? Explain two element Rosette gauge.  
   c) How the torque is measured by proney brake  

PART-IV

8 a) Sketch and label Mcloed gauge  
   b) How the force is measured by Proving ring  
   c) State the advantages of resistance thermometers.  

9 a) Explain with sketch Eddy current tachometer  
   b) How the flow of liquid is measured by rotometer  
   c) Describe briefly linear variable Differential transformers (LVDT),  

10 Write short note on any three of the following  
   i) Hygrometer  
   ii) Interchangability and selective assembly  
   iii) Plain plug gauge  
   iv) Optical Pyrometer.
MECHANICAL TESTING & QUALITY CONTROL LABORATORY

Subject Title : Mechanical Testing & Quality control Laboratory
Subject Code : M-
Periods/Week : 06
Periods/Semester : 96

Time schedule

<table>
<thead>
<tr>
<th>SL. No.</th>
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<th>No of periods</th>
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<tr>
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<td>Mechanical Testing</td>
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<tr>
<td>1</td>
<td>Hardness tests</td>
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<td>2</td>
<td>Impact Test</td>
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<td>3</td>
<td>Viscosity of oil</td>
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<td>Test on Lubricants</td>
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<td>5</td>
<td>Co-efficient of friction by Thurston oil tester</td>
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<tr>
<td>6</td>
<td>Tests on Universal testing machine</td>
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<tr>
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<td>Quality Control</td>
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<td>7</td>
<td>Linear measurements</td>
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<td>8</td>
<td>Angular measurements</td>
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<td>Screw thread measurements</td>
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<td>Ultrasonic Testing to detect flaw</td>
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<td>10</td>
<td>Dye penetrant test</td>
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<td>Industry Institute interaction</td>
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<td>Tests and revision</td>
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<td>Total</td>
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OBJECTIVES

On the completion of course a student should be able to:

1.0 Mechanical testing Laboratory – Understand the various material testing methods.
   1.1 Define the various properties of materials such as: yield stress, Ultimate stress, percentage elongation, Young’s Modulus.
1.2 Appreciate the importance of various mechanical properties such as hardness, impact strength. Perform tests to determine the above.
1.3 Conduct experiments on finding flash and fire points and co-efficient of viscosity of lubricants
1.4 Conduct experiments on finding Co-efficient of friction of oil.
1.5 Conduct tensile, compression, bending and shear tests on material by Universal testing machine
1.6 Study of various measuring instruments used in quality control area
1.7 Measurement of linear dimensions of objects
1.8 Measurement of angular dimensions of objects
1.9 Measurement of screw thread dimensions.
1.10 Know how to determine the surface and sub surface flaws in a product such as casting etc using ultrasonic unit
1.11 Know to determine the surface flaws by Dye penetrant test

COURSE CONTENTS
1. Determination of impact strength of the material using Izod and Charpy’s tests.
2. Determination of hardness of metal using Brinnel, Rockwell, and vicker hardness testing machines.
3. Determine co-efficient of viscosity of oil by redwood viscometer.
4. Determine flash and fire point of lubricants.
5. Determine co-efficient of friction of oil by using Thurston oil tester
6. Determination of yield stress, ultimate stress, percentage reduction in area, percentage elongation, Young’s modulus by conducting tension test on Universal testing machine.
7. Determination of yield stress, ultimate stress, percentage of increase in area, Young’s modulus by conducting compression test on Universal testing machine.
8. Conducting bending test on wood specimen by UTM
9. Study of measuring instruments such as dial gauge, micrometer, vernier height gauge, Vernier depth gauge, Gear tooth Vernier calliper, micrometer
11. Determination of Angular dimensions by using combination set, sine bar, slip gauges and universal bevel protractor.
12. Determination of effective diameter of screw thread by using i) two wire method ii) three wire method.
13. Detection surface and sub-surface cracks by ultrasonic portable equipment.
## SCHEME OF EVALUATION

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<th>Marks</th>
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<td>b) One experiment on Quality control</td>
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<td>2</td>
<td><strong>Conducting of Experiment</strong></td>
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<td>a) One experiment on Mechanical testing (Group of five)</td>
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<td></td>
<td>b) One experiment on Quality control (Individual)</td>
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<td><strong>Calculation, results, Inference (Both experiments)</strong></td>
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EQUIPMENT LIST FOR MECHANICAL TESTING & QUALITY CONTROL LAB

List of equipments needed for Mechanical Testing & Quality Control Lab:

1. Hardness Testing Machine
2. Impact Testing Machine
3. Red wood Viscometer
4. Thurston Oil Tester
5. Pensky Martin Flash & Fire point Equipment
7. Digital Vernier Calliper
8. Digital Vernier Height gauge
9. Gear Tooth Vernier
10. Universal Bevel Protractor
11. Digital Micrometer
12. Digital Screwgauge
13. Sine Bar & Slip Gauges
14. Portable Ultrasonic Equipment Tester
15. Spirit Level
16. Surface Plate (Granite)
TOPICANALYSIS

LIST OF EXPERIMENTS

PART – A
1.0 FORGING

1.1 Forging tools and their uses
1.2 Forging shop equipment and their uses
1.3 Forging practices
   a. Jumping
   b. Drawing
   c. Bending
   d. UP setting
   e. Punching and
   f. Swaging
   g. Flattening and Fullering
      1. Converting rounded into cube or rectangle
      2. Preparation of L – Hook with eye

1.4 Preparation of utility articles
   A. ‘A’ nail
   B. Flat hexagonal beaded bolt
   C. Square beaded bolt
   D. Square beaded bolt
   E. Gib beaded key
   F. Fag – bolt
   G. Eye - bolt
   H. Chain link
   I. Crowbar
   J. Nail puller
   K. Hammer
   L. U-bolt

1.5 Power hammer practice
   a. preparation of axe
1.6 Hardening tampering and annealing of chisel (including testing of Hardness)

PAR – B (FOUNDRY)

1. Foundry tools, equipment’s and their uses
2. Sand mixing and understand the ingredients of sand
3. Study of core, drain, check and the use of patterns
4. Practice on ramming and leveling
5. Cutting practice in a single box
   a. Square
   b. Hexagon
   c. Round
   d. Chipping block
6. Cutting practice by using two boxes
   a. Cast iron pulley
   b. Cast iron pipe
   c. Simple a
   d. Cast iron Benes
   e. Cast iron flame
7. Preparation of mould brushing using patterns and casting practice
   a. Cast iron chipping block
   b. Cast iron pulley
   c. Cast iron bracket
   d. Pelton wheel cup
   e. Loor handless (Steel casting)

**SCHEME OF VALUATION**

Two models to be prepared in two shop practices and evaluation of the model should be done as per scheme mention below

| Serial no | Description                                                         | Marks |
|-----------|                                                                    |       |
| 1         | Listing of tools & operations required for performing job           | 10    |
| 2         | Marking of job                                                      | 10    |
| 3         | Operation performed                                                 | 20    |
| 4         | Dimensional accuracy of job                                         | 20    |
| 5         | Finishing of job                                                    | 20    |
| 6         | Viva                                                                | 20    |
|           | **Total**                                                           | **100** |
DIPLOMA IN MECHANICAL ENGG.
(WELDING AND SHEET METAL TECHNOLOGY)
IIIRD SEMESTER

SUBJECT: WELDING SHOP-1(ARC)

SUBJECT CODE:

Contact Hrs/Week: 06                                                                     Total Hrs: 96 Hrs.

**Welding shop-1**

1. Demonstration of electric arc welding equipment and accessories
2. Demonstration of safety rules before starting to weld.
3. Demonstration how to connect the welding transformer and rectifier
4. Demonstration about selection of electrodes and setting the current, how to start an arc
5.0 Practical exercises
   5.1 Laying straight bends
   5.2 Laying bend with weaving machine
   5.3 Building a pad on a flat surface
   5.4 Multiplan fillet weld ;in down hand position
   5.5 Fillet weld in horizontal position
   5.6 Butt joints in flat position
   5.7 Lap and fillet welds(different exercise)
   5.8 Filet weld (thin plate to a thick plate)
   5.9 Laying bends in a vertical position welding downwards
   5.10 Laying bends in the vertical position welding upwards
   5.11 Fillet welds on corner joints (inside), lap joint , corner joint, and t- joint
## SCHEME OF EVALUATION

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DIPLOMA IN MECHANICAL ENGG.
(WELDING AND SHEET METAL TECHNOLOGY)
IIIRD SEMESTER

SUBJECT: WELDING TECHNOLOGY-I

SUBJECT CODE:

Contact Hrs/Week: 04                                                                     Total Hrs: 64 Hrs.

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<td>1</td>
<td>Introduction to welding technology and its developments</td>
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<td>2</td>
<td>Classification of welding process</td>
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<td>3</td>
<td>The welding arc</td>
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<td>Arc welding power source</td>
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<td>Shielded metal arc welding</td>
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<td>Submerged arc welding</td>
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<td>Gas tungsten arc welding</td>
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<td>Safety recommendation in welding</td>
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General educational objectives:

Upon the completion of the study of the subject, the student should be able to;
1. Understand the concept of welding, other alternative methods of fabrication and then field of applications.
2. Know the classification of welding processes.
3. Know the methods of arc initiation and different types of welding are
4. Study of the importance of arc welding power sources.
5. Know the consumables used in arc welding
6. Understand the operation of shielded metal arc welding.
7. Understand that principles an working of submerged arc welding.
8. Study the gas tungsten process.
9. Study the gas metal arc welding process
10. Know the safety recommendation in welding and cutting.

Specific Instructional objectives;
1.1 Give introduction to the process welding
1.2 Compare welding process with other fabricating process like casting, forming, machining and riveting process.
1.3 Describe the history of welding
2.1 Give the classification of welding process based on the method of heat generation and its application.
2.2 Give the classification of allied process
2.3 State the various welded box metal.
2.4 State the advantages of welding
2.5 State the disadvantages of welding
2.6 Mention the various practical applications of welding
3.1 Define an arc
3.2 Explain the structure and characteristics of an arc - the cathode spot, the cathode drop zone, the arc column, the anode and the anode drop zone.
3.3 State the formulae for calculation of arc efficiency
3.4 Solve simple problems
3.5 Explain arc blow and its electrical characteristics of arc with diagrams
3.6 Explain different types of welding arc
3.7 Explain the methods of arc initiation and arc maintenance
3.8 Explain the role of electrode polarity and arc stability.
3.9 State the various requirements for an arc welding power source.
4.1 State the various requirements for an arc welding power source.
4.2 Describe the volt-ampere characteristic of a welding power source.
4.3 Explain the external static volt ampere characteristic
4.4 Distinguish between constant current and voltage characteristics
4.5 Explain different types of V.I. characteristics.
4.5 Give the formula for calculation of static volt-ampere characteristic
4.6 Solve simple problems on V.I. characteristics
4.7 Explain operating principles of a welding transformer
4.8 State the requirements of a welding transformer
4.9 Mention the basic types of welding transformers
4.10 Explain with sketch the high reactance type welding transformer.
4.11 Explain the opposition series generator and a split pole d.c. generator.
4.12 State the advantages of a rectifier welding power source.
4.13 Explain the SCR welding power source.
5.1 Explain coated electrode stating its composition and sizes.
5.2 State the purposes of electrode coatings.
5.3 Distinguish between light coated and heavy coated electrodes.
5.4 Give the classification and coding of covered electrode for carbon and carbon-manganese structural steels (IS 814; 1991)
5.5 Explain welding rods and wires
5.6 State the various purposes of welding fluxes
5.7 Explain the two different shielding gases
5.8 State the mans and characteristics of other gases and gas mixtures used in arc welding.
6.1 Explain with sketch of equipment and equipment accessories used in shielded metal welding.
6.2 Give the sketches of weld joint design for SMAW
6.3 Sketch the electrical circuit diagram for SMAW
6.4 Explain the working operations of SMAW.
6.5 Explain the effect of metal fusion and weld penetration.
6.6 Explain with sketches of weaving pattern of electrode motions.
6.7 Give the sketches of different positions in welding.
6.8 State the variants of SMAW process.
6.9 State the applications of SMAW.
7.1 List the different saw equipment materials.
7.2 Draw the electrical circuit and setup for saw.
7.3 Explain the process and operations of saw.
7.4 Explain the process variables of saw.
7.5 Draw the sketch of joints and edge preparation of saw.
7.6 Describe the process of preparation required for welding.
7.7 State the applications of saw.
7.8 List the variants of saw.
8.1 List the various equipment and materials required for gas tungsten arc welding.
8.2 Draw the circuit diagram and setup for GTAW.
8.3 Explain briefly the steps involved in GTAW operation.
8.4 Give the joint design for GTAW.
8.5 State the applications of GTAW.
8.6 Mention the variants of GTAW.
9.1 List the various equipments and materials required for GMAW.
9.2 Draw the electrical circuit diagram and setup for GMAW.
9.3 Explain briefly the variables of GMAW.
9.4 Explain the operations of technique of GMAW.
9.5 Draw the joint design for GMAW.
9.6 State the applicant of GMAW.
9.7 Mention the variants of GMAW.
10.1 List the safety recommendation for operation of gas welding and cutting equipment.
10.2 List the safety recommendation for installation an operation of arc welding equipment.
10.3 Mention the necessary steps involved in protection against explosives, fuel and other hazards.
10.4 Give the necessary steps in protection against welding hazards.

Contents details
1.0 Introduction to welding technology and its developments
   1.1 Introduction
   1.2 Four fabrications processes and their fields of application – casting, forming, machining and welding
   1.3 History of welding

2.0 Classification of welding process
   2.1 Classification based on the method of heat generation and its application
   2.2 Classification of allied process
   2.3 Commonly welded base metals
   2.4 Advantages of welding
   2.5 Disadvantages of welding
   2.6 Practical application of welding
3.0 The welding arc
   3.1 Definition of an arc
   3.2 Structure and characteristics
      3.2.1 The cathode spot
      3.2.2 The cathode drop zone
      3.2.3 The arc column
      3.2.4 The anode and the anode drop zone
   3.3 Arc efficiency
   3.4 Arc blow
   3.5 Electrical characteristics of an arc
   3.6 Types of welding arcs
   3.7 Methods of arc initiation
   3.8 Role of electrode polarity
   3.9 Arc stability
   3.10 Simple problem on arc efficiency

4.0 Arc welding power sources
   4.1 Requirements for an arc welding power source
   4.2 Volt ampere characteristics of a welding power source
   4.3 External static volt ampere characteristic
   4.4 Constant current characteristics
   4.5 Constant voltage characteristics
   4.6 Selection of a static volt-ampere characteristic for welding process
   4.7 Simple problems on static volt-ampere characteristics
   4.8 A.C. power sources
      4.8.1 Operating principles of welding transformer
      4.8.2 Operating principles of welding transformer
      4.8.3 Basic types of welding transformer
      4.8.4 The high reactance types welding transformer
   4.9 D.C. welding power source
      4.9.1 Opposition series generator
      4.9.2 A split pole D.C. welding generator
   4.10 Rectified D.C. welding power source
   4.11 SCR welding power source

5.0 Arc welding consumables
   5.1 Coated electrodes
   5.2 Purposes of electrode coatings
   5.3 Light coated electrodes
   5.4 Heavy coated electrodes
   5.5 Classifications and coding of covered electrodes for carbon and carbon manganese structural steel
   5.6 Welding rods and wires
   5.7 Welding fluxes
   5.8 Shielding gases
   5.9 Other gases
   5.10 Gas mixtures

6.0 Shielded metal arc welding
6.1 Introduction
6.2 Equipment
6.3 Weld joint design for SMAW
6.4 Welding current
6.5 SMAW operations
6.6 Metal fusion and weld penetration
6.7 Electrode motions
6.8 positions in welding
6.9 variants in SMAW process
6.10 applications of SMAW

7.0 Submerged Arc welding
7.1 Introduction
7.2 SAW equipment and materials
7.3 electrical circuit and setup for SAW
7.4 SAW process and operation
7.5 process variables
7.6 types of joint and edge preparations
7.7 preparations for welding
7.8 procedure and techniques for automatic submerged arc welding
7.9 semi automatics submerged arc welding
7.10 applications
7.11 variants of SAW

8.0 Gas Tungsten Arc welding
8.1 Introduction
8.2 Equipment and Materials
8.3 GTAW Circuit and Set up
8.4 GTAW operation
8.5 Joint Design
8.6 Application
8.7 Variants of GTAW

9.0 Gas metal Arc Welding
9.1 Introduction
9.2 GMAW Equipment and material
9.3 Welding variant and setup
9.4 GMAW variables
9.5 GMAW operation and technique
9.6 Joint Design
9.7 Applications
9.8 Variants of GMAW

10.0 Safety Recommendations in welding and cutting
10.1 Introduction
10.2 Safety Recommendation for installation and operation of Gas welding and cutting equipment.
10.3 Safety Recommendation for installation and operation of Arc welding and cutting equipment.
10.4 Explosive, fire and other hazards.
10.5 Protection of welding.
REFERENCE BOOKS.

1. Welding processes and technology – Dr. Parmar.R.S
2. Welding technology- O.P.Khanna
3. Welding technology- Srinivasan.N.A
Model question paper

Welding technology-1

Note; 1. Question no.1 is compulsory

1. Answer any two full question in each section

Section-1

1. (a) 1X5=5

1. In arc welding---- is struck between work piece and electrode
2. Electro slag welding is a process of joining ------ steel sections in a single run
3. Both -----and--- power sources are used for GTAW.
4. Submerged arc welding is mainly used for ---- carbon and ---- steels
5. Thermo ionic emission involves the – electrons from the heated electrode.

(b) Write short notes on history of arc welding and gas welding

Section-2

2 (a) Mention the applications of costion and forming 06

(b) State the classification welding process based on the method of heat generation. 05

(c) What are the commonly welded base metals used in welding 04

3. (a). Define the welding arc 03

(b) Explain the mobile cathode spot mode 05

C. Mention the several mechanisms of electron emission mechaniss and explain any one of them 07

4. (a) Explain the static output characteristics of welding power source 05

(b) Describe the opposition series generation of d.c. power source 05

(c) The arc length voltage characteristics of a dc are in give by the equation v= 24+4l
where v is the voltage and l is the length in mm. The static volt. Ampere
characteristics of -power source is approximated by a straight line with no. Load
voltage of 80 volts and the short-circuit current of 600 amperes. Determine the 05
 optimum arc length for maximum power.
Section-3

5(a) Explain briefly the coated electrodes 05
(b). State the purposes of electrode coatings 05
(c) . Mention the basis for coating of electrodes 05
6. (a) Explain the equipment for SMAW 05
B. Draw a circuit diagram for SMAW 05
C. Draw a neat sketch showing three motions of an electrode during welding05
7. (a) Write an electrical circuit diagram for submerged arc welding 05
(b) Explain briefly the semi – automatic SAW 05
(c) State the applications of SAW 05

Section – 4

8 (a) Draw a neat circuit diagram for GTAW 05
(b) Mention the joint design for GTAW 06
(c) State the applications of GTAW 04
9 (a) Draw a neat circuit diagram for GMAW 05
(b) Show with neat sketches of different types of joint designs used for GMAW 05
(c) State the applications of GMAW 05
10(a) State the safety recommendations for installation and operation of gas welding and cutting operation07
(b) Explain 1. Fire hazards 08
2. Explosive hazards
THEORY OF MACHINES

Subject Title : Theory of Machines
Subject Code : M-
Hours Per Week : 04
Hours Per Semester : 64

TOPIC ANALYSIS

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General Objectives

On completion of the course, the student should be able to

1. Know the definitions of Theory of Machines
2. Understand the Kinematics of Machines, their Mechanisms & Inversions
3. Understand the friction involved in bearings, clutches & brakes
4. Know different methods of transmission of power
5. Understand different types of cams and their motions and also to draw cam profiles for various motions
6. Know different types of vibration and to understand critical speed of shaft
7. Understand balancing of masses in the same plane
8. Know different types of governors

Subject Content Details

1.0 Introduction
   1.1 Definition of TOM
   1.2 Sub – divisions of TOM
2.0 Basic kinematics of Machines
   2.1 Kinematic link or element
2.2 Types of links
2.3 Kinematic pair –types
2.4 Types of constrained Motions
2.5 Kinematic chain
2.6 Machine, Structure and Mechanism
2.7 Difference between Machine and Structure
2.8 Difference between Machine and Mechanism
2.9 Inversions
2.10 Types of Kinematic Chains
2.11 Four Bar Chain
   2.111 Beam Engine
   2.112 Coupling Rod of Locomotive
   2.113 Watt’s Indicator Mechanism
2.12 Single Slider Crank Chain
   2.121 Pendulum Pump
   2.122 Oscillating cylinder engine
   2.123 Rotary I.C Engine
   2.124 Crank and Slotted Lever Quick Return Motion Mechanism
   2.125 Whitworth Quick Return Motion Mechanism.
2.13 Double Slider Crank Chain
   2.131 Elliptical trammel
   2.132 Scotch yoke mechanism
   2.133 Oldham’s coupling
3.0 Friction
3.1 Introduction
3.2 Friction in Journal Bearing
3.3 Power Transmission in the above bearing
3.4 Friction in Thrust Bearing
   3.41 Pivot Bearing – Flat and Conical bearing
   3.42 Collar Bearing – Single and Multiple
3.5 Problems on bearings – assuming uniform pressure theory
3.6 Friction in Clutches
   3.61 Single Disc Clutch
   3.62 Multiple Disc Clutch
3.7 Problems on clutches – assuming uniform wear theory
3.8 Introduction to Brakes
3.9 Internal Expanding Brake (Mechanical & Hydraulic)
3.10 Disc brake
3.11 Dynamometer
3.12 Difference between Brake and Dynamometer
3.13 Difference between Brake and clutch
4.0 Transmission of Power
4.1 Types of Belt Drives
4.2 Length of belt –open and cross belt drives
4.3 Velocity Ratio, Ratio of driving Tensions, Centrifugal Tension and Initial Tension
4.4 Power Transmitted by belts( flat and V) and ropes
4.5 Maximum power transmitted by belt (without proof)
4.6 Problems on belt drives
4.7 Introduction to Gears
4.8 Classification of Gears
4.9 Spur Gear Terminology
4.10 Problems on gears
4.11 Introduction to Gear Trains
4.12 Types of Gear trains –Simple, Compound, Reverted and Epicyclic gear trains
4.13 Problems on Gear Trains

5.0 Cams
5.1 Introduction
5.2 Classification of cams
5.3 Classification of followers
5.4 Terminology of Radial disc cam
5.5 Displacement diagram for the following Motion of follower
   5.5.1 Uniform velocity
   5.5.2 Simple Harmonic Motion (SHM)
   5.5.3 Uniform Acceleration and Retardation Motion (UARM)
5.6 Velocity and acceleration during Out stroke and Return stroke of follower during SHM and UARM
5.7 Cam profile construction for
   5.8.1 Knife edge follower
   5.8.2 Roller follower

6.0 Mechanical Vibrations
6.1 Introduction
6.2 Terms used in Vibrations
6.3 Types of Vibrations
   6.3.1 Free Vibrations
   6.3.2 Forced Vibrations
   6.3.3 Damped Vibrations
6.4 Types of Free Vibrations- Longitudinal, Transverse and Torsional
6.5 Critical or Whirling speed of a shaft

7.0 Balancing
7.1 Introduction
7.2 Static and Dynamic balancing
7.3 Balancing of single rotating mass in the same plane of projection
7.4 Balancing of several masses rotating in the same plane of projection
7.5 Problems on above (Analytical and Graphical methods)

8.0 Governors
8.1 Introduction
8.2 Types of Governors
8.3 Centrifugal Governor
8.4 Terms used in governors
8.5 Watt Governor
8.6 Porter Governor

Specific Instruction Objectives

1.0 Introduction
   1.1 Define the term Theory of Machines
   1.2 Define and explain briefly kinematics, dynamics, kinetics and statics

2.0 Basic kinematics of Machines
   2.1 Define kinematic link and list its characteristics
   2.2 Explain rigid, flexible and fluid link with examples
   2.3 Define kinematic pair and explain in detail its classifications based on type of relative motion, type of contact and type of closure
   2.4 Explain 3 types of Constrained Motion with examples
   2.5 Define and explain kinematic chain. Give the relation between link, joint and kinematic pairs
   2.6 Define and Explain with examples machine, structure and mechanism
2.7 List the difference between Machine and Structure
2.8 List the difference between Machine and Mechanism
2.9 Explain Inversion with an example
2.10 List types of Kinematic chains
2.11 Explain with sketches, four bar chain and its inversions
2.12 Explain with sketches, single slider Crank Chain and its inversions
2.13 Explain with sketches, double slider Crank Chain and its inversions

3.0 Friction
3.1 Explain the advantages and disadvantages of Friction
3.2 With sketch explain friction in Journal Bearing
3.3 Solve a simple problem on Torque and Power transmission in Journal Bearing
3.4 Explain friction in thrust bearing
   3.4.1 Explain with sketch types of Pivot Bearings
   3.4.2 Explain with sketch types of collar Bearings
3.5 Simple problems on the above bearings involving calculation of Intensity of pressure, Friction torque and power lost in friction (Number of collars in Multiple collar bearings)
3.6 Define clutches and explain Friction in Clutches
   3.6.1 Explain with sketch single disc clutch
   3.6.2 Explain with sketch multiple disc clutch
3.7 Solve simple problems on clutches involving power transmission, dimensions of the friction plates, number of active surfaces, intensity of pressure between discs, number of plates required and axial force to engage the clutch
3.8 Briefly explain brakes, its advantages and disadvantages
3.9 Explain with sketch Internal expanding brake (Both Mechanical & Hydraulic-actuated)
3.10 Explain with sketch Disc brake.
3.11 Explain Dynamometer
3.12 List the differences between Brake and Dynamometer
3.13 List the differences between Brake and Clutch

4.0 Transmission of Power
4.1 List the types of belt drives
4.2 Explain the equation to determine the length of belt in open and cross belt drives (Derivation of equation not required)
4.3 Explain the terms Velocity ratio, ratio of driving tensions, centrifugal tension and initial tension with related expressions
4.4 List the expressions to determine power transmitted by flat belt, v belt and rope drives
4.5 Explain the condition for Maximum power transmission
4.6 Solve simple problems involving length of belt, width of belt, power transmitted by belts and ropes, number of v-belts/ropes
4.7 Briefly explain toothed wheel concept with advantages and disadvantages of Gear drives
4.8 List classification of Gears
4.9 Define and explain terms used in gears
4.10 Solve simple problems on gears involving exact centre distance, number of teeth on meshing gears, velocity ratio and power transmitted
4.11 Briefly give introduction to gear trains
4.12 With sketches explain different types of gear trains
4.13 Solve simple problems on simple and compound gear trains involving number of teeth on meshing gears, speed of Driver or Follower
5.0 Cams

5.1 Briefly give introduction about cams
5.2 List and explain with sketches, classification of cams
5.3 List and explain with sketches, classification of followers
5.4 Define and explain terms used in radial disc cams
5.5 Draw and explain displacement diagram for the follower with Uniform velocity, simple harmonic motion and uniform acceleration and retardation motions
5.6 Calculate velocity and acceleration during out stroke and return stroke of follower during SHM and UARM
5.6 Draw the profile of the cam considering radial and offset for knife edge follower and roller follower during UV, SHM and UARM

6.0 Mechanical Vibrations

6.1 Briefly explain the vibration phenomenon
6.2 Define the terms used in vibrations
6.3 Explain different types of vibrations
6.4 With sketches explain different types of free vibrations
6.5 Explain in detail critical or whirling speed of a shaft discuss the equation to determine critical or whirling speed (derivation not required)

7.0 Balancing

7.1 Discuss the conditions for unbalance and the necessity of balancing
7.2 Define and explain the static and dynamic balancing
7.3 Explain in detail balancing of single rotating mass in the same plane of projection
7.4 Explain in detail balancing of several masses rotating in the same plane of projection
7.5 Solve simple problem on above conditions both by analytical and graphical methods

8.0 Governors

8.1 Explain the function of a governor
8.2 List the types of governors
8.3 Explain with sketch working principle of centrifugal governor
8.4 Explain various terms used in governors
8.5 With sketch explain working of watt governor
8.6 With sketch explain working of porter governor

Reference Books :

1. Kinematics of Machines---J B K Das, Sapna Publication
2. Dynamics of Machines-----J B K Das, Sapna Publication
4. Theory of machines-------- P.L.Ballaney , Khanna publication
5. Theory of machines-------- Thomas Bevan ,CBS publication
6. Theory of machines--------Malhothra & Gupta
8. Theory of machines--------R.K.Bansal ,Laxmi publication
Model Question Paper  
Mechanical Engineering Board  
Fourth Semester  
2010-2011  
THEORY OF MACHINES  

Max.Marks:100                                                                                                  Time: 3Hrs

Note : 1. Question No.1 is compulsory  
2. Answer any two full questions from each of the remaining sections  
3. Any missing data may be suitably assumed

1. a) Fill in the blanks with appropriate word /words  
   i) Hydraulic press is a __________ link.  
   ii) Type writer constitutes a __________ 
   iii) The size of the cam depends on ______________ circle. 
   iv) The product of diametrical pitch and circular pitch is equal to________ 
   v) The brakes are commonly used in cars__________

   b) Describe with a neat sketch single plate clutch . 

5x1=5

SECTION-I

2. a) Define Theory of machines .                                                                                   2
   b) Explain three types of constrained motions.                                                           6
   c) Describe with a neat sketch , the crank and slotted lever quick return motion mechanism.                                                                 7

3. a) Explain with a neat sketch ,Scotch yoke mechanism .                                            6
   b) What is pivot bearing ? Give its applications.                                                        4
   c) A conical pivot bearing supports a vertical shaft of 200 mm diameter. It is 
subjected to a load of 30 KN. The angle of the cone is 120 degree and the 
co-efficient of friction is 0.025 .Find the power lost in friction, when the speed 
is 140 rpm, assuming uniform pressure condition.                                                  5

4. a) What is the function of clutch ?                                                                                2 
   b) Differentiate between brake and clutch .                                                                  5
   c) A multiple disc clutch has five plates having four pairs of active friction 
surfaces . If the intensity of pressure is not to exceed 0.127 N / sq. mm ,find the 
Power transmitted at 500 rpm .The outer and inner radii of friction surfaces 
Are 125 mm and 75 mm respectively. Assume uniform wear.                               8

SECTION-II

5. a) List the types of belt drives .                                                                                     3
   b) Explain what do you understand by “Initial Tension in a belt”. .                                                2
   c) An open belt running over two pulleys 240 mm and 600 mm diameters connects 
two parallel shafts 3 m apart and transmit 4 kw from the smaller pulley that 
rotates at 300rpm .The co-efficient of friction between the belt and pulley is 0.3 
and the safe working. Tension is 10 N /mm width. Determine the 
i) minimum width of the belt ,
ii) initial tension and
iii) length of belt required.

6 a) List the classification of toothed wheels.  
   b) Explain with a neat sketch, the compound gear train.  
   c) Draw the nature of displacement, velocity and acceleration diagrams, when the follower moves with SHM.

7 a) Define the following terms related to radial disc cam.  
    i) Base circle  
    ii) Prime circle & iii) Pitch circle  
   b) Why the Roller follower is preferred over the knife edge follower.  
   c) Draw the profile of the cam with knife edged follower is raised through a distance of 30 mm in 1/3 rd of revolution of the cam and is lowered in 1/3 rd revolution with equal intervals between these movements. The follower must move with the following data:  
      Out stroke-----SHM  
      Return stroke---Constant acceleration. 80 degree & constant retardation. 40 degree.

SECTION-III

8. a) What is the function of a Governor?  
    b) Define the following terms used in Governors  
       i) Height of the governor  
       ii) Mean equilibrium speed  
       iii) Sleeve lift  
   c) Explain with a neat sketch, the working of Centrifugal governor.

9 a) Explain the different types of Free vibrations with sketches.  
    b) What do you mean by balancing?  
    c) Explain the balancing of single rotating mass by a single mass in the same plane

10 a) Briefly explain static balancing.  
   b) A shat carries two rotating masses 5 kg and 2 kg attached at radii 300 mm and 600 mm respectively from axis of rotation. The included angle between two radii is 60 degree. Find the angular position and radius of rotation of balance mass if its mass is 3 kg. If no balance mass is used, what is the out of balance force on shaft bearing at 400 rpm.  
   c) Four masses m1, m2, m3 & m4 are 200 kg, 300 kg, 240 kg & 260 kg respectively. The corresponding radii of rotation are 200 mm, 150 mm, 250 mm, & 300 mm respectively and the angles between successive masses are 45 degree, 75 degree & 135 degree. Find the position and magnitude of the balance mass required by graphical method, if its radius of rotation is 200 mm.
MANUFACTURING TECHNOLOGY - II

Subject Title : Manufacturing Technology-II(WSM)
Subject Code : W-
Hours Per Week : 04
Hours Per Semester : 64

TOPIC ANALYSIS:

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Objectives:
On completion of the course the students should be able to:
1. Understand the various Rectilinear machine tools like Shaper, Planer & Slotter, their uses, mechanisms & applications.
2. Understand the concepts of grinding, their techniques & superfinishing processes & applications.
3. Understand Non-conventional machining methods, applications & limitations in manufacturing
4. Understand the concept of computer aided design.
5. Know the working of computer aided manufacturing.
6. Understand robotics.
7. Understand the importance of jigs & fixtures, methods & applications in manufacturing
8. Understand the plastic processing methods, applications & limitations in manufacturing
9. Understand the concepts of powder metallurgy, methods, process & applications in manufacturing.

CONTENTS
1.0 Shaper, Planer & Slotter
   1.1 Introduction to Shaper & Classification
   1.2 Specifications of Shaper
   1.3 Principal parts of shaper.
   1.4 Shaper Mechanisms & Shaper Operations
   1.5 Cutting Speed, Feed, Depth of cut & Machining time.
   1.6 Simple problems.
   1.7 Introduction to Planer & Classification
1.8 Specifications of Planer
1.9 Principal parts of Planer
1.10 Planer Mechanisms & Operations
1.11 Differences between Planer & Shaper
1.12 Introduction to Slotter & Classification
1.13 Principal parts of Slotter
1.14 Specifications of Slotter
1.15 Slotter Mechanisms & Operations
1.16 Difference between Planer & Slotter.

2.0 Grinding & Surface finishing
2.1 Introduction to grinding & Classification
2.2 Plain Cylindrical grinding machines
2.3 Grinding wheels
2.4 Abrasives & classification.
2.5 Bond & bonding.
2.6 Grit, Grade & Structure of wheels.
2.7 Specification of wheels.
2.8 Types of grinding wheels.
2.9 Selection of grinding wheels.
2.10 Mounting of grinding wheels.
2.11 Glazing and loading of wheels.
2.12 Dressing and truing of wheels.
2.13 Balancing of wheels.
2.14 Diamond wheels.
2.15 Introduction to surface finish.
2.16 Surface finishing operations.

3.0 Modern machining
3.1 Introduction to modern machining.
3.2 Differences between conventional and non-conventional methods.
3.3 Classification.
3.4 Principle of working of - Ultrasonic machining, Electric discharge machining, Abrasive jet machining and Laser beam machining.
3.5 Applications, merits and demerits of above methods.

4.0 NC and Machines
4.1 Introduction
4.2 Difference between conventional and NC machines
4.3 Main components of NC machine.
4.4 Classification of NC machine.
4.5 Working principle of NC machines.
4.6 Measuring systems for control.
4.7 Computerized NC machines
4.8 Computerized CNC machine
4.9 Compare NC and CNC machine

5.0 Introduction to CAD/CAM AND ROBOTICS
5.1 CAD- Definition..Importance
5.2 CAD system
5.3 Computer applications in designs.
5.4 Advantages of CAD.
5.5 Hardware in CAD.
5.6 Colour and animation in computer graphics
5.7 Input and output devices
5.8 Introduction to CAM.
5.9 NC motion control system
5.10 Applications of NC.
5.11 Advantages and dis-advantages of NC.
5.12 Introduction to Robotics
5.13 Importance of robotics in industry
5.14 Physical configuration of robot.
5.15 Robot motion-Six degrees of freedom.
5.16 Methods of robot programming
5.17 Robot programming language
5.18 Robot applications.

6.0 Jigs and Fixtures
6.1 Introduction to jigs and fixtures.
6.2 Definition of jig and fixtures.
6.3 Types of jigs and fixtures.
6.4 Applications & merits of jig and fixture.

7.0 Plastic processing
7.1 Introduction to plastics.
7.2 Types of plastics.
7.3 Plastic processing – Moulding process, compression, transfer, injection & Extrusion.
7.4 Principle of thermoforming and calendaring.

8.0 Powder metallurgy
8.1 Basic concepts of powder metallurgy.
8.2 Methods of powder metallurgy.
8.3 Process for powder metallurgy.
8.4 Secondary operations for powder metallurgy.
8.5 Applications, merits and limitations of powder metallurgy.

SPECIFIC INSTRUCTIONAL OBJECTIVES

1.0 Shaper, Planer & Slotter
1.1 Classify the shapers and explain the same.
1.2 Specifications of Shaper
1.3 Draw the line diagram of standard shaper with parts.
1.4 List the shaper mechanisms and study of hydraulic shaper mechanism - Crank & Slotted Link mechanism
1.5 List shaper operations.
1.6 Definition of cutting speed, feed, depth of cut & machining time.
1.7 Simple problems.
1.8 Classify the Planers and explain the same.
1.9 Specifications of Planer
1.10 Draw the line diagram of standard planer with parts.
1.11 List the planer mechanisms and study of open and cross belt drive mechanism.
1.12 List planer operations.
1.13 Differences between planer & shaper
1.14 Classify slotter and explain the same.
1.15 Draw the line diagram of slotter with parts.
1.16 Specifications of Slotter
1.17 List slotter mechanisms & operations
1.18 List the differences between planer & slotter.

2.0 Grinding & Surface finishing
2.1 Introduction to grinding & Classification
2.2 Study of plain cylindrical grinding machine.
2.3 Explain grinding wheels
2.4 Explain abrasives & their classification.
2.5 Explain bond & bonding.
2.6 Explain grit, grade & structure of wheels.
2.7 Explain specification of wheels.
2.8 List the types of grinding wheels.
2.9 List the factors for selection of grinding wheels.
2.10 Explain mounting of grinding wheels.
2.11 Explain glazing and loading of wheels.
2.12 Explain dressing and truing of wheels.
2.13 Explain balancing of wheels.
2.14 Short note on diamond wheels.
2.15 Explain lapping, honing, superfinishing and electroplating with neat sketches.
2.16 Explain polishing, buffing, pickling and oxidizing.

3.0 Modern machining
3.1 Explain non-conventional / modern machining
3.2 Explain differences between Conventional & Non-conventional Machining methods
3.3 Classification of Non-conventional machining methods.
3.4 Sketch & Explain Ultra sonic machining, Electro Discharge machining, Abrasive Jet Machining & Laser Beam Machining.
3.5 Explain Applications, merits & demerits of above methods.

4.0 UNDERSTAND THE CONCEPT OF NC AND CNC MACHINES.

4.1 Give introduction about NC and CNC machines.
4.2 Give the difference between conventional and NC machines.
4.3 Describe the main components of NC machines.
4.4 Give the classification of NC machines.
4.5 Explain the working principles of NC machines.
4.6 Explain the measuring systems for control
4.7 Explain computerized NC machines.
4.8 Explain computerized CNC machines.
4.9 Give the comparison of NC and CNC machines.

5.0 Give a brief introduction about CAD/CAM.
5.1 Give the definition and importance of CAD
5.2 Explain CAD system.
5.3 Mention the computer applications in design.
5.4 Give the advantages of CAD.
5.5 Explain colouring and animation in computer graphics.
5.6 Give introduction to CAM.
5.7 Explain NC Motion control system.
5.8 Give the applications of NC.
5.9 Give the advantages and disadvantages of NC.
5.10 Appreciate the importance of Robotics.
5.11 Explain the importance of robotics in industry.
5.12 Sketch the physical configuration of robot.
5.13 Explain the six degrees of freedom of robot motion.
5.14 Explain the methods of robot programming.
5.15 List the robot programming language.
5.16 Mention the application of robot in different fields.

6.0 Jigs and Fixtures
6.1 Explain the jig & fixture
6.2 Definition of jigs & fixtures, principles of location of jigs.
6.3 Explain the different types of jigs & fixtures.
6.4 Explain the various applications of jigs & fixtures.
6.5 Materials used for jigs & fixtures.

7.0 Plastic processing
7.1 Explain the importance of plastics in manufacturing process.
7.2 Explain briefly Polymerization process – Addition Polymerization & Condensation
7.3 Polymerization
7.4 Explain briefly the additive agents – Plasticizers, Fillers, Catalysts, Initiators, Dyes & Pigments & solvents.
7.5 Explain briefly plastic processing - Moulding process, Compression, Transfer, Injection & Extrusion
7.6 Explain briefly machining of plastics
7.7 Explain briefly – Calendering & Blow Moulding of plastics

8.0 Powder metallurgy
8.1 Explain the concept of powder metallurgy.
8.2 Explain the methods of metal powder manufacturing – Atomization, Electrolytic deposition, Reduction, Crushing & Milling, Granulation & Shotting.
8.3 Explain with sketches process for powder metallurgy – Mixing, Compacting & sintering
8.4 Explain secondary operations -
8.5 Methods of powder metallurgy.
8.6 Process for powder metallurgy.
8.7 Secondary operations for powder metallurgy.
8.8 Applications, merits and limitations of powder metallurgy.

Text Books:

REFERENCE BOOKS
1) Workshop Technology by Hazara choudary VOL - I & VOL – II.
2) Production Technology by Dr.P.C.Sharma., S Chand & Co
3) Workshop technology by B.S.Raghuvamshi
5) Production Technology by R.K.Jain.
6) Manufacturing Technology I & II , Dr P C Sharma , S Chand & Co
7) Manufacturing Technology - P P Date , Jaico Publishing House

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MODEL QUESTION PAPER

SUBJECT : MANUFACTURING TECHNOLOGY – II

SUBJECT CODE : _______

TIME : THREE HOURS

TOTAL MARKS : 100

Note : 1) Section – I is compulsory.
2) Answer any TWO FULL QUESTIONS FROM SECTION – II, III & IV

SECTION – I

Q – I ) a) State a) Fill in the blanks with appropriate words
   i) The vertical shaper is also called as ________
   ii) Maximum amount of material is removed in ________ milling machine.
   iii) Laser beam machining is a type of ________ machining.
   iv) ________ is used to guide the tool only.

1X5 = 5
v) ___________ is used for carrying away the heat generated between the cutting tool & workpiece.

b) Explain briefly the Jigs & Fixtures

SECTION – II

Q – II )  a) Explain with a neat sketch Whithworth Quick Return Mechanism of Shaper. 07
b) List the various types of bonds used in grinding wheels. 03
c) Explain briefly Vitrified bonding process 05

Q – III )  a) Mention the differences between Shaper & Slotter machines 05
b) Draw the standard Shaper & list its main parts 05
c) Explain briefly the surface grinders. 05

Q- IV )  a) Explain briefly Dressing & Truing for a grinding wheel 05
b) Define Honing, Lapping & Super finishing processes 05
c) List & briefly explain five grinding operations 05

SECTION – III

Q – V )  a) Explain with neat sketch Ultra Sonic Machining process 06
b) List all the indexing methods. Explain Compound Indexing procedure. 06
c) List the limitations of non-conventional machining processes 03

Q- VI )  a) With a block diagram briefly explain Plano-Miller. 05
b) List the advantages of Non Traditional Machining processes. 05
b) Explain briefly the procedure of checking Gear Teeth dimensions 05

Q- VII )  a) Explain briefly the T Slot cutting operation in Milling machine 05
b) Sketch Up Milling & Down Milling Processes. 05
c) Sketch & name the parts of LBM hot working 05

SECTION – IV

Q – VIII )  a) List the various properties of cutting fluids. 05
b) What are the advantages of Powder metallurgy. 05
c) List the methods of Plastics processing. 05

Q- IX )  a) Explain briefly the Powder Metallurgy process with suitable sketches. 06
b) Give the classification of lubricants & give applications for each. 06
c) List the various types of lubricants 03

Q- X )  a) Write short notes on the following: (5 x 3) = 15
i) List the various types of jigs. Explain briefly any one of them.
ii) Machining of Plastics
iii) Explain the basic principles of location for jigs.
MACHINE SHOP-I

Subject Title : Machine shop-I

Subject Code : 

Periods per Week : 06

Periods per Semester : 96

OBJECTIVES

On the completion of the course the student should be able to:

1.0 Know the working of Lathe and be in a position to operate the same.

1.1 Perform a plain turning operation on a lathe machine.
1.2 Select proper tool to perform the job.
1.3 Make use of various measuring instruments for taking dimensions.
1.4 Perform various lathe operations on a lathe.
1.5 Calculate the taper angle.
1.6 Know the different taper turning methods on a lathe.
1.7 Turn the required tapers by swivelling the compound rest and tail stock set over method.
1.8 Produce articles of industrial application such as ring gauges, plug gauges, handle etc.

2.0 Graded Exercises

A) STUDY EXERCISES

2.1 Use of marking and measuring tools used in machine shop such as Surface plate, Angle plate, Scribing block, Try square, Combination set, Odd leg Caliper, Divider, dot punch, Center punch, Calipers, Vernier Calipers, Digital Calipers, Vernier height gauge, Outside and inside micrometers and Digital micrometers.

2.2 Study of Lathe, Drilling machine, shaping machine and slotting machine. Study of drives and mechanisms used in these machines.

2.3 Study of Grinding of Lathe tools to the required angle

B) PRACTICE EXERCISES

- Turning practice on mild steel specimen to an accuracy of ± 0.25 mm.
- Preparing at least FIVE models involving the following operations.
Machine Shop (Turning)
2.4 Plain Turning
2.5 Step Turning
2.6 Taper Turning.
2.7 Turning Collars
2.8 Knurling
2.9 Facing
2.10 Chamfering,
2.11 Parting
2.12 Thread cutting (Cutting of External and Internal Threads - Right hand and Left hand threads)

C) SERVICING OF MACHINE TOOL (Lathe)

2.13 The dismantling some of the components of lathe and then assemble the same
2.14 List the faults associated with lathe and its remedies
2.15 The routine and preventive maintenance procedure for lathe

SCHEME OF EVALUATION

One model should be turned comprising of all the operations practiced in the shop practice and the same may be evaluated as per scheme shown below

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<thead>
<tr>
<th>Serial no</th>
<th>Description</th>
<th>Marks</th>
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<tbody>
<tr>
<td>1</td>
<td>Listing of tools &amp; operations required for performing job</td>
<td>05</td>
</tr>
<tr>
<td>2</td>
<td>Marking of job</td>
<td>05</td>
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<tr>
<td>3</td>
<td>Operation performed</td>
<td>20</td>
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<tr>
<td>4</td>
<td>Dimensional accuracy of job</td>
<td>15</td>
</tr>
<tr>
<td>5</td>
<td>Finishing of job</td>
<td>20</td>
</tr>
<tr>
<td>6</td>
<td>One question on servicing aspects of lathe</td>
<td>15</td>
</tr>
<tr>
<td>7</td>
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OBJECTIVE:

At the end of the course, the student should be able to:

- Understand what is Machine drawing is all about?
- Get hold on Modeling software environments
- Start sketching and creating profiles
- Know the meaning of constraints and constraining
- Realize the nature of Parametric and feature based modeling concepts
- Know the bi-directional associatively
- Create part model, assemblies and the related drawing views
- Be able to produce/create models/drawings as per industry standards


Define and understand the following terms:
Planes and their creation, reference axis, Sketch, Profile, constraints-geometrical and dimensional, need for constraining, fully constrained, under constrained, over constrained.

2. Part Modeling:
Conversions of 2D profiles into 3D models-using extrude/protrude and revolve commands. Cutouts/shell creation, placing holes, rounds/fillets, chamfers, creating rectangular and circular array/patterns, array/patterns along a path/curve, mirroring features, editing of a model, creating internal and external threads. Adding draft,
ribs, thin wall features, lip to models. Creating vents, boss. Creating swept and lofted models.

Using part modeling techniques create the following Part Models any 10 (see list).

and learn how to generate different Drawing views
Front View
Top View
and Side/Profile view/auxiliary view/section view with annotations.

3. Model the following machine parts using equations:
   - Hexagonal Nut and Bolt
   - Solid Muff Coupling
   - Bushed Journal Bearing
   - Foot Step Bearing
   - Knuckle Joint
   - Socket and Spigot joint

4. Assembly Modeling:

   Know the assembly environment, setting the assembly environment, types of assembly design approach-bottom-up and top-down assembly.
   Creating assembly and sub-assemblies
   Editing and modifying assembly relationships
   Creating exploded view of the assembly,
   Inserting Bill of Materials,
   Adding Balloons
   Understand Detail drawing
   Know the procedure for detail drawing
   Creation of Production drawing.

Using assembly modeling techniques create the following:
   - Plummer Block
   - Screw Jack
   - C-clamp
   - Coupling Puller
   - Pipe vice
### Scheme of Examination

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<td>Create the model and drawing views(any 3) along with dimensions and annotations as per sketch given</td>
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<td><strong>OR</strong></td>
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<td></td>
<td>Create the model and drawing views(any 3) along with dimensions and annotations using equations</td>
<td>30</td>
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<tr>
<td>2</td>
<td>Create the assembly model and drawing with dimension, BOM, Balloons- as per the given sketch</td>
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This Lab can be performed using **ANY ONE** of the following softwares:

1) Solid Edge
2) UniGraphics
3) IronCAD
4) CATIA
5) ProE
6) SolidWorks
7) INVENTOR
DIPLOMA IN MECHANICAL ENGG.
(WELDING AND SHEET METAL TECHNOLOGY)
IVth SEMESTER

SUBJECT: SHEET METAL TECHNOLOGY

SUBJECT CODE:

Contact Hrs/Week: 04                                                                     Total Hrs: 64 Hrs.

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<td>Plastics</td>
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<td>8</td>
<td>Pneumatic and hydraulic tools</td>
<td>05</td>
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<td>Test and Revision</td>
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<td>Total</td>
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Specific instructional objectives

1.0 Introduction to sheetmetal technology
   1.1 List at least five different jobs in the sheet metal industry and describe the basic duties of each.
   1.2 List and explain at least five uses of sheetmetal in the trades and in industry
   1.3 List the areas of shop work in which the skilled sheet metal worker must be sufficient

2.0 Sheetmetal working tools and machinery
   2.1 List and describe the use of at least ten sheet metal working hand tools
   2.2 Identify by their proper name all the hand tools
   2.3 Identify their proper name all the snips
   2.4 Identify all the sheet metal working machines by their proper name and describe their basic purpose
   2.5 With a drawing be able to explain the difference between a single cut file and a double cut file and explain the advantage of each
   2.6 Explain the difference between a cornice brake a bar folder and a press brake
   2.7 Draw a sectional view of the wheels and the burring machines and the turning machines and the elbow machine
   2.8 Explain the difference between cramping and bending
   2.9 Identify by name at least three out of five stakes when show the stakes

3.0 Safety in the sheet metal shop
   3.1 Work safety in the sheet metal shop and the job
   3.2 Recognize and correct safety hazards in the sheet metal shop
   3.3 Correct unsafe actions on other workers
   3.4 Explain low electric shocks occur and what can be done to prevent them
   3.5 Explain what the safety hazards are when soldering and explain how to avoid them

4.0 Sheetmetal types
   4.1 Give the thickness of piece of sheet metal taken from a gauge table
   4.2 Tell the type of gauge used on any of the common sheetmetals
4.3 Read the thickness of the sheet metal by using a micrometer caliper
4.4 Explain the difference the steel and non-ferrous metals
4.5 Describe the characteristics of the any of the common sheet metals

5.0 Sheet metal operations

6.0 Materials and fasteners for sheet metals
   6.1 Sketch sectional views of at least five different mild steel shapes and show on each how the size is designated
   6.2 Explain the difference between wire cloth, expanded metal and cone metal
   6.3 Describe the wire cloth products that the sheet metal worker uses
   6.4 Define hot-rolled and cold rolled steel
   6.5 Describe tinner rivets and explain how they are designated for size
   6.6 Explain how machine screws and bolts are designated
   6.7 Describe sheet metal screw and leg bolts
   6.8 Describe the following welding process
      6.8.1 Oxy acetelyne
      6.8.2 Arc
      6.8.3 MIG
      6.8.4 TIG
      6.8.5 SPOT

7.0 Sheet metal patterns
   7.1 Able to develop the pattern for any object that requires the parallel line method to develop the pattern
   7.2 Give at least four examples of the type of object for which triangulation is used to develop the pattern
   7.3 Using triangulation, layout the patterns for rectangular transition and round taper
7.4 Able to develop the for round taper a pitch and truncated right cone cut at an angle

8.0 plastics
8.1 define thermo setting and thermo forming plastics
8.2 list at least four advantages of plastic over sheetmetal
8.3 List the disadvantages of plastic
8.4 Describe low pvc plastic in fabricated
8.5 Describe low pvc plastic in welded
8.6 List at least three different plastic that are used in place of sheetmetal for duct, pipe or doors

9.0 pneumatic and hydraulic tools
9.1 identify all the pneumatic and hydraulic tools by their proper name and describe their basic purpose
9.2 with a drawing be able to explain the working principle of pneumatic tools for riveting drilling and hammering
9.3 explain the difference between cone rollers and corrugated rollers
9.4 draw a sectional view of circular shearing machine

1.0 Introduction to sheet metal technology
1.1 Introduction
1.2 Job categories
1.3 Fundamentals of sheet metal work-

2.0 sheet metal working tools and machinery
2.1 Hand tools- scratch awls, dividers, steel square, trammel points, rule,
2.2 punches- prick punch, center punch, solid punch, hollow punch, hand lever punches
2.3 Hand Grover
2.4 Rivet set
2.5 Chisels – Flat cold chisel, cape chisel, diamond point chisel, round nose chiesel
2.6 Hammers
2.7 Mallet
2.8 Snips
2.9 Pliers
2.10 Handy seamer or tongs
2.11 Soldering coppers
2.12 Hacksaws
2.13 Files
2.14 Bench stakes & stake holders
2.15 Machine and machine supports

2.16 Bench machines – Burring machines, turning machine, wiring machine, creping and beading machine, double seaming machine, elbow edging machine, beading machine, rotary circular shears, combination machines, hand brake, pan brake, power shears, pron brake

3.0 Safety in the sheet metal shop
3.0 Positive attitude
3.1 General safety
3.2 Squaring shears
3.3 Brakes
3.4 Soldering
3.5 Sheet metal
3.6 Welding
3.7 Power tools
3.8 Noise control
3.9 House keeping

4.0 Sheet metal types
4.1 Steel sheet metals – coated and solid sheets, sheet steel gages, measuring tools
4.2 Galvanized sheet metal
4.3 Stainless steel
4.4 Tin plate
4.5 Non – ferrous sheet metals – copper, Aluminum, lead, zinc
4.6 Oxiden of metal

5.0 Sheet metal operations
5.1 Sheetmetal cutting operations
   5.1.1 Operations for producing blanks
   5.1.2 Operations for cutting holes
   5.1.3 Operations for progressive working
   5.1.4 Miscellaneous operations
5.2 Sheet metal forming operations – bending, flanging, hemming, seaming, curling, wiring, ribbing, staking, crippling, bulging, beading, enclosing, tube forming and forming
5.3 Sheetmetal drawing operations - chipping, box drawing, panel drawing, shallow, panel drawing deep

6.0 Materials and fasteners for sheetmetal
   6.1 Mild steel shapes
   6.2 Materials for openings
   6.3 Pipe and tubing
   6.4 Wire and dampers
   6.5 Fasteners - rivets, bolts and machine screws
       Sheet metal screws installations fasteners
   6.6 Welding

7.0 Sheet metal patterns
   7.1 Introductions
   7.2 Methods of developing patterns
   7.3 Parallel line developments
       7.3.1 Developing patterns for rectangular duct
       7.3.2 Developing patterns for round pipe
   7.4 Triangulation method of lay out
       7.4.1 Laying out a rectangular transition
       7.4.2 Laying out a round taper
   7.5 Radial line developments
       7.5.1 Laying out the pattern for a round taper on a pitch
       7.5.2 Truncated right cone cut at an angle

8.0 Plastics
   8.1 Introduction
   8.2 Types of plastics
   8.3 Production of plastics
8.4 Fabricating thermo plastics
8.5 Fabricating thermo cells

9.0 Pneumatic and hydraulic tools
  9.1 Pneumatic tools for riveting, drilling, hammering
  9.2 Hydraulic pipe bending machine
  9.3 Cone rollers and corrugated curved rollers
  9.4 Circular shearing

Reference Books
1. Sheetmetal shop practice
   - Leo A. Meyer and Alfred B. Deletoile

2. Techniques of press working sheetmetal
   - Donald F. Eary and Edward A. Reed
MODEL QUESTION PAPER
SHEET METAL TECHNOLOGY

NOTE: (1) Question no 1 is compulsary
(2) Answer any two full question in each section

1. (a) 1X5=5
   i. Hand groover is used for grooving a seam by ------.
   ii. The snips are used for all routine ------.
   iii. Sheet metal gauge is used for measuring and determining the ------of metal.
   iv. Bar folder is used for ----- edges of 22 gauges metal or lighten.
   v. Double hem is simply a single hem done.-------.

(b) . explain briefly sheet metal fabricator. 05

2. a. Describe the planning and layout of sheet metal work. 05
    b. Name the different types of scratch tools and explain any one of them 05
    c. explain the use of hand groover. 05

3. a. Describe a riveting hammer. 05
    b. explain with a net sketch the burring machine. 05
    c. Describe the press brake with a neat sketch 05

4. a. explain what fish hookes are in sheet metal work 05
    b. what are the most common causes of cuts from sheet metal. 05
    c. what are the reasons for having safety rules from sheet metal 05

   SECTION-2

5. a. explain the use of micrometers in sheet metal shop.05
    b. mention the non-ferrous sheet.-metal used in sheet meta shop an explain any one
       of them. 05
    c. what is the oxide of a metal and explain its importance05

6.a. explain the following sheet metal operations 06
    i. blanking  ii. Shearing
    b. explain the following i. punching ii. Slotting 06
c. what is notching. 03

7. a. sketch sectional views of two different mild steels shops. 05
    b. explain wire cloth used to cover openings 05
    c. explain the difference between grills and registers 05

SECTION-IV

8.a. Mention the methods of developing pattern. 03
    b. Draw a development for rectangular duct 06
    c. Draw a rectangular transition development 06

9. a. Define thermosetting and thermo forming plastics 06
    b. Explain the following i. solvent ii. Catalysts 06
    c. Explain tack welding 03

10.a. Describe with a neat sketch circular shearing machine. 06
    b. Explain with a neat sketch the hydraulic pipe bending machine. 05
    c. Draw a pneumatic tool for drilling. 04
1. Demonstration of gas welding equipments and safety rules.
2. Demonstration about attaching regulators, hoses and torch and types of flames.
3. Demonstrations of back fires and trouble shooting.
4. Practicing various types of welds.
5. Blind weld, double weld, flanged butt weld, square butt weld, single v butt weld, double v butt weld, corner weld, filler weld, pipe butt weld, pipe single v butt weld.
6. Practice of different methods of gas welding—left hand welding
   - Right welding
   - Vertical welding
   - Horizontal welding
   - Over head welding
7. Preparation of utility article and pipe joints using gas welding
   Utility article
   a) Bucket
   b) Dust bin
   c) Mug
   d) Small Tray
8. Practice of gas cutting an 10mm thick plate—straight cutting and circle cutting.
## SCHEME OF EVALUATION

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<tr>
<td>2</td>
<td>Listing of tools and operations performed</td>
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<td>3</td>
<td>Planning, Marking and calculations (if any)</td>
<td>10</td>
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<tr>
<td>4</td>
<td>Operations performed and finishing</td>
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<td>5</td>
<td>Dimensional accuracy</td>
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DIPLOMA IN MECHANICAL ENGG.
(WELDING AND SHEET METAL TECHNOLOGY)
IVth SEMESTER

SUBJECT: WELDING TECHNOLOGY-II

SUBJECT CODE:

Contact Hrs/Week: 04                                                                     Total Hrs: 64 Hrs.

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<td>Resistance welding</td>
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<td>Soldering, Brazing and Adhesive bonding</td>
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<td>Metal Surfacing and spraying</td>
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General Educational objectives

1. Study the electro slag and electro gas welding
2. know the various resistance welding processes
3. understand, the gas welding process
4. know the basic principles, soldering, brazing and adhesive bending.
5. understand the process selection.
6. appreciate the importance the metal surfacing and materials required
7. know the coating characteristics and evaluation of metal spraying.
8. understand the basic idea of thermal cutting process.
9. know the importance of economics in welding.

Specific Instructional Objectives.

1.0 study the electro slag and electro gas welding
1.1 Define the process electro slag and electro gas welding
1.2 explain the basic equipments and materials required namely power source, wire feeder, electrode guide tube, retaining block, welding head and controls and materials rotated to electro slag welding.
1.3 Draw electrical circuit and a setup for ESW.
1.4 explain ESW operation and techniques
1.5 explain briefly the essential process variables included in ESW- welding current welding voltage, electrode diameter, electrode extension, electrode oscillation and number of electrode and their spacing
1.6 explain with diagram the deposition rates of ESW process
1.7 Draw the sketches of various weld joint designs
1.8 explain weld structure and preparation
1.9 state the applications of ESW
1.10 mention the various variants of the process
1.11 Define the process electro gas welding
1.12 explain with the sketches, the setup and process details of electro gas welding
2.1 explain the basic principles of resistance welding process.
2.2 explain the resistance spot welding process with sketches showing setup and process details
2.3 Draw the basic circuit components of resistance spot welding
2.4 state the four basic elements of welding cycle.
2.5 list and explain the welding variables
2.6 state the different resistance welding equipment
2.7 explain the machine rating
2.8 list the types of equipment used in resistance spot welding
2.9 explain a rocker/arm type spot welding machine with sketch.
2.10 explain with a sketch a press type machine
2.11 sketch the different tip designs for spot welding electrodes.
2.12 list sketch the different spot welding electrodes
2.13 explain the characteristics weld ability showing the relationship
2.14 list the variants of spot welding
2.15 Define the seam welding process
2.16 explain with sketches seam welding machines and process details.
2.17 list and sketches of seam welding electrodes
2.18 sketch the typical joint designs for seam welding
2.19 state the applications of seam welding process
2.20 list the variants of seam welding
2.21 explain projection welding with sketch showing electrode and work positioning for projection welding
2.22 state the application of projection welding
2.23 explain the variant of projection welding
3.1 list the various gases employed in gas welding
3.2 state the properties, production and storage of different gases
3.3 Draw sketch standard setup for oxy-acetylene welding
3.4 explain the structure of an oxy-acetylene flame.
3.5 explain with sketches different types of flames
3.6 state the welding procedure required to ignition and adjustment of flame.
3.7 list and explain with sketches the different technique used in gas welding.
3.8 explain briefly the quality of gas weld compare with arc welding
3.9 list and sketch the different joint design of gas welding.
3.10 state the various application of gas welding.
3.11 explain the variants of oxy-fuel gas welding
4.1 Define soldering, brazing an adhesive bending
4.2 Distinguish between soldering, brazing and adhesive bonding
4.3 explain the various factors involved in soldering process
4.4 sketch the typical joint design for soldering
4.5 list a give the composition of solders.
4.6 write not on fluxes.
4.7 explain the steps involved in making a soldered joint.
4.8 list the soldering methods and equipments
4.9 explain the meaning of step soldering
4.10 state the steps followed to achieve the optional strength in a brazed joint.
4.11 list the various brazing process
4.12 explain heat treatment of brazed components
4.13 state the uses of brazing process
4.14 explain the variants of brazing- braze welding.
4.15 explain the nature of adhesive joints
4.16 give the classifications of adhesives
4.17 sketch the joint design showing types of loading and loading applications
4.18 explain the strength of joint an adhesive joint
4.19 explain the steps involved in making adhesive joints.
4.20 write a note on tercing and qualities of adhesive joints.
4.21 state the applications of adhesive bonding
4.22 list the various steps needed for safety.

5.1 explain the technical consideration involving in selection of welding process
5.2 list the various characteristics of a materials that affect the selection of a elders process.
5.3 explain the various factors which involves in production considerations which affect the selection of welding process.
5.4 explain the various components of costs considered in economic consideration
5.5 explain the different types of production that are fabricated by welding.
5.6 Draw the flow chart for process selection
5.7 Give conclusion about process selection
6.1 List and explain the various types of wear.
6.2 List and explain the different types of surfacing.
6.3 Name the various methods that can be employed for surfacing.
6.4 explain the surfacing process by using oxy-acetylene welding
6.5 explain the surfacing method by using smaw
6.6 explain the surfacing process by using plasma arc welding
6.7 explain briefly the factors considered for selection of a surfacing process.
6.8 explain method of substrate
6.9 state the classification and characteristics of surfacing materials.
6.10 state the six types of combinations of producing wear.
6.11 explain the steps involved in surfacing
6.12 state the various application of surfacing
6.13 state the process that involves in metallizing
6.14 List the methods applied for surface preparation.
6.15 explain the different methods of surface preparations /machining, bond coating and abrasive blasting
6.16 write note in marking
6.17 state the materials used for metallization
6.18 List the various processes which are used for metal spraying.
6.19 sketch and explain the flame spraying and wire flame spraying.
6.20 write note on coating characteristics and evaluation.
6.21 state the application of met spraying
7.1 Give the classification of the thermal cutting process
7.2 explain with neat sketch the oxy-fuel gas cutting process.
7.3 state the application of oxy-fuel gas cutting
7.4 explain arc cutting process showing a set up for carbon arc cutting and air carbon arc cutting
7.5 explain the process plasma arc cutting
7.6 explain the high energy beam cutting processes- electron beam cutting, laser beam cutting.
8.1 state the various stages involving in the basic operations in the welded fabrication of general engineering products.
8.2 explain the procedure for the preparation of material to be welded.
8.3 state the major factors to be considered in the design of weld joints.
8.4 sketch the different backs an wedges used for structural assembly
8.5 explain the components of welding cost –equipment cost, consumable cost labour cost and overhead costs.
8.6 Define productions
8.7 state the various specification of welding includes for enhancing productivity
8.8 Write not on post welding operation, scrap allowance and standard time and cost
8.9 State the different time factors considered for standard time.
8.10 solving simple problem on standard time and cost calculation.
1.0 Electro slag and electro gas welding

1.1 Introduction

1.2 Equipment and material
   1.2.1 Power source
   1.2.2 Wire feeder
   1.2.3 Electrode guide tube
   1.2.4 Retaining blocks
   1.2.5 Welding head and controls
   1.2.6 Materials

1.3 Electrical circuit and a setup for ESW

1.4 ESW operation and technique

1.5 Process variables

1.6 Deposition Rates

1.7 Weld joint design

1.8 Weld structure and properties

1.9 Applications

1.10 Variants of ESW

1.11 Electro gas welding
   1.11.1 Setup and process details of EGW
   1.11.2 Uses

2.0 Resistance Welding

2.1 Introduction

2.2 Basic principles of process

2.3 Resistance spot welding
   2.3.1 Spot welding sequence
   2.3.2 Welding cycle

2.4 Welding variables

2.5 Resistance welding equipment

2.6 Machine rating
2.7 types of equipment
2.8 spot welding electrodes
2.9 weldability
2.10 Seam welding
   2.10.1 Seam welding electrodes
   2.10.2 Joint design
   2.10.3 Applications
   2.10.4 Variants of resistance seam welding
2.11 projections welding
   2.11.1 Heat balance
   2.11.2 Applications
   2.11.3 Variants of projection welding
3.0 Gas welding
   3.1 introductions
   3.2 gases
   3.3 setup and equipment
   3.4 the oxy-Acetylene flame
      3.4.1 types of flames
   3.5 flame ignition and adjustment
      3.5.1 gas welding techniques
   3.6 weldability
   3.7 weld joint design
   3.8 applications
   3.9 variants of Oxy-fuel gas welding
4.0 Soldering, Brazing and Adhesive Bonding
   4.1 Soldering mechanism
      4.1.1 Soldering mechanism
      4.1.2 Solders
      4.1.3 Fluxes
      4.1.4 Joint design
      4.1.5 Soldering procedure
      4.1.6 Soldering methods and equipment
      4.1.7 Step soldering
   4.2 Brazing
4.2.1 Joint design
4.2.2 Cleaning the joint face
4.2.3 Selecting the flux
4.2.4 Selection of a Brazing process
4.2.5 Post cleaning and inspections
4.2.6 Heat treatment and brazed components
4.2.7 Uses
4.2.8 Variants of the process

4.3 adhesive bonding
4.3.1 Introduction
4.3.2 Nature of adhesive joint
4.3.3 Adhesive and their classification
4.3.4 Joint design
4.3.5 Joint strength
4.3.6 Bonding methods
4.3.7 Testing and quality control
4.3.8 Applications
4.3.9 Safety precautions

5.0 process selection
5.1 introductions
5.2 criteria for process selection
5.3 type of product
5.4 flow chart for process selection
5.5 conclusions

6.0 metal surfacing and sprayings
6.1 surfacing
6.2 types of wear
6.3 types of surfacing
6.4 surfacing methods
6.5 selection of a surfacing process
6.6 mention of substrate
6.7 classification and characteristics of surfacing materials
6.8 selection of a surfacing material
6.9 surfacing procedure
6.10 quality control
6.11 spraying application
6.12 introduction Metal sprayings
6.13 surface preparation
6.14 marking
6.15 metallizing materials and their selection
6.16 metallizing processes
6.17 coating characteristics and evaluation
6.18 applications

7.0 thermal cutting process
  7.1 introduction
  7.2 oxygen cutting process
  7.3 arc cutting process
  7.4 high energy beam cutting

8.0 economic in welding
  8.1 introduction
  8.2 material preparation
  8.3 assembly and preheating
  8.4 welding costs
  8.5 productions
  8.6 post- welding operations
  8.7 scrap allowance
  8.8 standard time for welding and flame cutting
  8.9 standard time and cost variations

REFERENCE BOOKS
2. The science and practice of welding vol 1 & 2 – A C Daves
3. Welding Technology – O.P. Khanna
4. Welding Engg – R D Agarwal and Tahil Maughnani
5. Welding Tech – K N Gupta & Kaushika

Model Question paper
Welding Technology –II
Note : 1 Question no 1 is compulsory

1x5=5
Section -I
1. (a) Electro slag is a welding process for joining thick work pieces by a single pass. 
2. Electro gas welding is a process that combines the features of gas metal arc welding and ----. 
3. Seam welding is a continuous type of welding spreads over --- surface. 
4. Wetting is the property by which it spreads over surface. 
5. Dip brazing is accomplished by clean and assembled parts into a molten bath. 

Section-2

2 (a) Draw a neat electrical circuit for electro slag welding 05 
(b) Mention the process variables of ESW and explain any one of variable process 06 
(C) State the applications of ESW 04 

3 (a) Draw a set-up diagram for ESW 05 
(b) State the uses of EGW 04 
(C) Explain EGW process 06 

4 (a) Explain basic principles of process of resistance welding 05 
(b) Explain 1 welding cycle 2 squeeze time 05 
(C) Explain projection welding 05 

Section-3

5 (a) Draw a set up diagram for oxy-acetylene gas welding 05 
(b) Draw a neat sketch of single-stage gas regulators 05 
(C) State the applications of oxy fuel gas welding 05 

6A. Explain soldering 05 

B. Describe torch brazing 05 

C. Explain adhesive bonding 05 

7. A. State the criteria for a process selection 03 

B. explain thermal conductivity and co-elf of thermal expansion 06 

C. explain structural fabrications 06 

Section-4
8.A. Mention the types of surfacing 03
   b. Explain surfacing by oxy-acetylene welding 05
   c. Describe with a neat sketch flame spraying 07
9. a. Explain briefly the oxy fuel gas cutting 05
     Process
   b. Explain the air carbon arc cutting process 05
   c. Describe the electron beam cutting 05
10. a. Mention the different stages which are involved in welding fabrication of engineering products 05
    b. State the various of components of welding costs 05
    c. Explain the scrap allowance 05
COURSE: WELDING AND SHEET METAL TECH  
CLASS: VTH SEM  
SUBJECT: ADVANCE WELDING AND ALLIED PROCESS  
SUB CODE: WS  
NO. OF HRS/WEEK: 4HRS  
TOTAL NO. OF HRS: 64 HRS

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GENERAL EDUCATIONAL OBJECTIVES

(1) Know the various welding process.  
(2) Study the friction welding and explosive welding process.  
(3) Know the fundamentals of cold pressure welding.  
(4) Study the process of joint design and variant of friction welding.  
(5) Know the electron beam welding process.  
(6) Understand the laser welding process & plasma Arc welding.  
(7) Know the automation in welding system.  
(8) Introduction to under water welding processes.

SPECIFIC INSTRUCTIONAL OBJECTIVES

1.0 Define solid state welding process, explosive welding and cold pressure welding.

2.0 What are the fundamentals considerations and process characteristics.
2.1 State the different modes of friction welding.
2.2 Explain friction-welding machine.
2.3 Define joint design, application-giving variant of friction welding.

3.0 State the general description and principle of explosive welding.
   3.1 State the various steps in welding.
   3.2 Write the different methods of operation of explosive welding.
   3.3 Define the impact velocity; standoff distance and angle of application.
   3.4 What are the weld joint properties.
   3.5 Write a note on variant of explosive welding.

SECTION - II

4.1 What are the essential requirements of cold pressure welding.
4.2 State the joint design and surface preparation.
4.3 Write the equipments set up and techniques required for cold pressure welding.
4.4 What are the butt-welding characteristics.

5.0 Induction & PAW.
   5.1 Definition & concept.
   5.2 Principles of operation, advantage and application.
   5.3 Equipment & process description.
   5.4 Write briefly the set up and process details and used for electro gas welding.

6.0 Define electron beam welding.
   6.1 What are the principle operations of electron beam welding.
   6.2 Write the parts of EBW gun.
   6.3 What are the characteristics of EBW.
   6.4 Write a note on process variables.
   6.5 What are the applications of EBW.

SECTION - III

7.1 Define laser beam welding.
7.2 What are the principle and mechanism of laser operation.
7.3 Write note on process parameters.
7.4 Write briefly laser weld characteristics.
7.5 What are the applications of laser beam welding.

8.0 Introduction to welding Automation.
8.1 welding sequence & classification of processes.
9.0 Under water welding processes.
9.1 Problems, Types of UW Welding processes.
9.2 Applications.

COURSE CONTENT

1.0 SOLID STATE WELDING
   1.1 Definition and advantages of solid state welding processes viz.. Friction welding, Explosive welding & Cold pressure Welding.

2.0 FRICTION WELDING
   2.1 Different modes of Friction welding.
   2.2 Fundamental considerations & process characteristics.
   2.3 Friction welding machines & Equipments.
   2.4 Welding variables of Friction welding process & weld properties.
   2.5 Joints design applications, Variants of Friction welding.

3.0 EXPLOSIVE WELDING
   3.1 General description and Principle of Explosive welding.
   3.2 Various steps in welding.
   3.3 Component arrangement for parallel stand off method & angular stand off method.
   3.4 Methods of operation.
   3.5 Process variables.
   3.6 Impact velocity, stand off distance & angle of approach.
   3.7 Weld joint properties & applications.
   3.8 Variant of Explosive welding.

SECTION - II

4.0 COLD PRESSURE WELDING
   4.1 Essential requirements.
   4.2 Basis of Weld formation.
   4.3 Joints design & Surface preparation.
   4.4 Equipments, Setup & Techniques.
   4.5 Lap welding, Butt welding, multiple upset Butt welding.
   4.6 Butt welding characteristics, applications, variant of cold pressure welding.

5.0 PLASM ARC WELDING
   5.1 Introduction to PAW.
   5.2 Definition & concept.
   5.3 Principle of operation.
5.4 Equipment & process description.
5.5 Advantages & application.
5.6 Definition of Electro Gas welding.
5.7 Set up & process details of Electro Gas welding.
5.8 Applications of Electro Gas welding.

6.0 ELECTRON BEAM WELDING
6.1 Define EBW.
6.2 Principles of operation of EBW.
6.3 Equipment of EBW.
6.4 Parts of EBW.
6.5 Different components of EBW system.
6.6 Characteristics of EBW.
6.7 Process variables.
6.8 Application of EBW.

SECTION - III

7.0 LASER BEAM WELDING
7.1 Definition.
7.2 Principle & Mechanism of Laser Beam Welding.
7.3 Ruby Equipment & setup.
7.4 Process parameters.
7.5 Laser weld characteristics & variant of Laser Beam.
7.6 Applications.

8.0 AUTOMATION IN WELDING
8.1 Introduction.
8.2 Welding sequence & classification of process.
8.3 Manual, automatic, automated, semi automatic welding.
8.4 Adoptive control.
8.5 Remote & Robot welding.
8.6 Types of Robot, precaution in use of Robot, application
8.7 Selection of a welding system.

9.0 UNDER WATER WELDING PROCESSES
9.1 Problems in under water welding.
9.2 Types of underwater welding.
9.3 Characteristics of a good under water welding.
9.4 Under water welding processes.
9.5 Application.

REFERENCE BOOKS:
2. Welding Technology -O. P. KHANNA
SCHEME OF EXAMINATION

Section I compulsory
1. a) Fill in the blanks-
   b) 05 marks

Section II, III, IV answer any two full question
   from each section 90 marks
   Total 100 marks

PAPER SETTING

Section I
1. a) Fill in the blanks (from all chapter) 05 marks
   b) 05 marks

Section II  Set 3 question each carry 15 marks 45 marks

Section III Set 3 question each carry 15 marks 45 marks

Section IV Set 3 question each carry 15 marks 45 marks
### BASIC MANAGEMENT SKILLS & INDIAN CONSTITUTION

#### TOPIC ANALYSIS

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1. MANAGEMENT SKILLS

1.1 INTERPERSONAL SKILLS.

1.11 Know Thyself/ self—Discovery.
1.12 Know others and understand the perspective of others.
1.13 Intergroup communications.
1.14 Art Of Communications
1.2 TEAM BUILDING and TEAMWORK SKILLS.

1.21 Aspects of team building.
1.22 Team v/s Group.
1.23 Inter group collaboration.

2. OPERATIONS MANAGEMENT
2.1 Production & Productivity
   2.1.1 Stages involved in Product Design
   2.1.2 Factors considered while designing a Product
   2.1.3 Types of Production
   2.1.4 Factors to improve Productivity
2.2 Production, Planning & Control
2.3 Make or Buy Decision
   2.3.1 Criteria considered for make or buy decision
   2.3.2 Analysis for make or buy decision
2.4 Purchasing
   2.4.1 Methods of Purchasing Material or Component
   2.4.2 Steps involved in purchasing of material or component
2.5 Stores Management
   2.5.1 Methods of Storing
   2.5.2 Tools required for Stores Management
   2.5.3 Codification System
2.6 Logistics Management
   2.6.1 Different means of Transportation
   2.6.2 Routing & Delays, Tracing, Packaging & Material Handling,
       Damage Claims, Demurrage Charges and Insurance Buying
2.7 Inventory & Inventory Control
   2.7.1 Functions of Inventory Control
   2.7.2 Inventory Control Techniques
   2.7.3 Inventory Management Software
2.8 Introduction to MRP and ERP

3. TOTAL PREVENTIVE MAINTENANCE

3.1 Maintenance and concept of TPM
3.2 Economics involved in preventive maintenance
3.3 Techniques of TPM
3.4 Benefits of TPM
3.5 Planned Maintenance and Predictive Maintenance
4. TOTAL QUALITY MANAGEMENT
   4.1 Quality and Inspection
      4.1.1 Factors affecting Quality
      4.1.2 Relation between Quality & Cost
      4.1.3 Quality Control
   4.2 Concept of TQM
      4.2.1 Tools and Techniques of TQM
   4.3 Quality Management System
      4.3.1 I.S.O 9000:2000 Quality Standards
      4.3.2 Procedures and Documentation of ISO 9000 certification

5. SAFETY AND ENVIRONMENTAL ISSUES
   5.1 Accident and Safety
   5.2 Accident Prevention, Accident Reporting and Crisis Management
   5.3 Safety provisions under Indian Factories Act
   5.4 Safety Management System-OSHAS 18001
   5.5 Environmental issues addressed by organization

6. INDIAN CONSTITUTION
   6.1 Indian Constitution-Formation of Constituent Assembly-Framing of the Constitution-Drafting Committee-Contributions of Dr. B R Ambedkar, Chairman of Drafting Committee and the members in drafting a constitution for India.
   6.2 Preamble-objectives-Directive principles
   6.3 Features of Constitution
   6.4 Fundamental Rights
   6.5 Fundamental duties
   6.6 Amendments for Indian Constitution
   6.7 Human Rights

7. PARLIAMENTARY SYSTEMS AND PROCEDURES.
   7.1 Government-Meaning-organs-functions.
   7.2 Parliament-meaning-Two houses-Lok Sabha-Composition-election-Presiding officer-term-RajyaSahba-Composition-election-Presiding officer-term
   7.3 Powers of parliament
   7.4 Executive Role - President-Vice President-Prime Minister-Council of Ministers
   7.5 Indian Judiciary system-Supreme Court-High Court-subordinate courts
   7.6 Constitutional bodies-Election Commission-Public Service Commission-Finance Commission
   7.7 Structure of State government-State Legislature-Governor-Chief Minister-Council of Ministers
7.8 Local self government—meaning—Three tier system—Village panchayath—taluk panchayath—Zilla panchayath
7.9 Local bodies—Municipalities and Corporations

8.0 EMPOWERMENT OF WOMEN.

8.1 Concept, Definition and need for Women's Empowerment
8.2 Strategies, approaches, process, levels, principles and indicators for women’s empowerment.
8.3 Gender statistics in India—Glaring inequalities
8.4 Women and Development:
   8.4.1 Goals and Objectives of National Policy for Women's Empowerment
   8.4.2 Advancement of Women through Five-Year Plans
   8.4.3 Special Programs for Women's Development.
8.5 Constitutional Provisions towards Women's Rights and Special Legislations for Women.
8.6 Case Studies.

SPECIFIC INSTRUCTIONAL OBJECTIVES

1. MANAGEMENT SKILLS

1.1 INTERPERSONAL SKILLS.

1.11.1 Importance of knowing yourself-Process of knowing yourself.
1.11.2 SWOT analysis-Benefits of SWOT analysis
1.11.3 SWOT analysis grid and questions to complete the grid.
1.12.1 Importance of knowing others-Process of knowing others.
1.13.1 Resolving Win/Lose Situations into win/win through inter group communications.
1.14.1 Defining communication- Special features of communication.
1.14.2 Communication process- Channels of communication.
1.14.3 Formal and informal communication network.
1.14.4 Barriers to communication- Tips of effective communication.

1.2 TEAM WORK AND TEAMWORK

1.21.1 Meaning and aspects of team building- Skills needed for teamwork- A model of team building.
1.22.1 Team v/s Group- Characteristics of a effective team- Role of a team leader- Role of a team members- A successful team of nine persons.
1.23.1 Inter group collaboration- Advantages of inter group collaboration.
1.23.2 Difficulties faced in inter-group collaboration.  
1.23.3 Factors shaping inter group collaboration.

2. OPERATIONS MANAGEMENT  
2.1 Define Production & Productivity  
2.1.1 Explain various stages involved in product design  
2.1.2 List factors considered while designing a product  
2.1.3 Explain Job, Batch & Mass production with their advantages and disadvantages  
2.1.4 List factors to improve/increase productivity  
2.2 State the functions of PPC- planning, routing, scheduling, dispatching and inspection  
2.3 State the importance of make or buy decision  
2.3.1 List the criteria considered for make or buy decision  
2.3.2 Briefly explain methods of analysis for make or buy decision - Simple cost analysis, Break even analysis & Economic analysis  
2.4 Define purchasing  
2.4.1 Explain briefly different methods of purchasing the material or component.  
2.4.2 Explain the steps involved in purchasing of Material or Component  
2.5 Explain Stores Management  
2.5.1 Explain different methods of storing  
2.5.2 Explain briefly Bin Card, Material Issue Requisition, Material Returned Note and Store Ledger  
2.5.3 Explain advantages and systems of Codification  
2.6 Explain Logistics Management  
2.6.1 Explain different means of transportation  
2.6.2 Explain Routing & Delays, Tracing, Packaging & Material Handling, Damage Claims, Demurrage Charges and Insurance Buying  
2.7 Define Inventory and Inventory Control  
2.7.1 List important functions of Inventory Control  
2.7.2 Explain briefly Inventory Control Techniques – ABC, VED, SDE, MNG Analysis  
2.7.3 List few Inventory Management Softwares  
2.8 Describe about MRP & ERP. List the software’s used  

3. TOTAL PREVENTIVE MAINTENANCE  
3.1 Explain Maintenance and explain the concept of TPM  
3.2 Explain the economics involved in preventive maintenance  
3.3 Describe the techniques of TPM  
3.4 List the benefits of TPM  
3.5 Explain planned maintenance and predictive maintenance  

4. TOTAL QUALITY MANAGEMENT
4.1 Define Quality, Inspection & explain its importance
   4.1.1 List factors affecting quality
   4.1.2 Explain the relation between cost & quality
   4.1.3 Define and Explain quality control
4.2 Explain concept of TQM
   4.2.1 Explain briefly tools & techniques of TQM – Flow charts, Control charts, Histograms, Pareto charts, Check sheets, Scatter diagram, Cause and effect diagram, 5-S, Poka-yoke, Kaizen, Re-engineering and Six-sigma
4.3 Define QMS
   4.3.2 Explain procedures and documentation involved in ISO 9000 series certification
5. SAFETY AND ENVIRONMENTAL ISSUES
   5.1 Define accident and safety
   5.2 Explain accident prevention, accident reporting and crisis management
   5.3 List the safety provisions under Indian Factories Act
   5.4 Explain Safety Management System-OSHAS 18001
   5.5 Give a brief summary of ISO 14000 series and IS16949 & IS16959 certifications
6. INDIAN COSTITUTION
   6.1 Introduction to Indian Constitution
   6.2 Discuss the Formation of Constituent Assembly
   6.3 Discuss the Contributions of Dr. B R Ambedkar as a Chairman of Drafting Committee and the members in drafting a constitution for India.
   6.4 Discuss Preamble and its main objectives
   6.5 State the Directive principles
   6.6 Discuss the Features of Constitution
   6.7 Mention the number of parts, articles, schedules and discuss the article -1
   6.8 Discuss Fundamental Rights
   6.9 Discuss Fundamental duties
   6.10 Explain the Amendment and its procedure
   6.11 Discuss Human Rights and its significance
7. PARLIAMENTARY SYSTEM
   7.1 Discuss the Parliamentary system of Government.
   7.2 Discuss the about:
      7.2.1 Loka Sabha: Composition, election, Presiding officer and term
      7.2.2 RajyaSabha: Composition, election, Presiding officer and term
   7.3 Powers of parliament
      7.3.1How law is made, three readings
7.3.2 Difference between Bill and act
7.3.3 Administrative control- Explain importance of questioning- concept of Question hour- concept of zero hour
7.3.4 Briefly explain about Confidence motion and Censure motion
7.4 Explain the meaning of the budget
7.5 President-Vice President-Prime Minister-Council of Ministers their appointments and functions
7.6 Discuss the formation and functions of supreme court-High court-Subordinate court.
7.7 Discuss the importance of Constitutional bodies-Election Commission-Public Service Commission-Finance Commission
7.8 Discuss the about state legislature:
7.8.1 Legislative assembly: Composition, election, Presiding officer and term
7.8.2 Legislative council: Composition, election, Presiding officer and term
7.9 Governor-Chief Minister-Council of Ministers their appointments and functions
7.10 Local self government-meaning-Three tier system
7.11 Discuss the formation and functions of Village panchayath-taluk panchayath-Zilla panchayath and urban local bodies such as Municipalities and Corporations

8. Empowerment of Women

8.1 Explain the Concept and Definition of Women's Empowerment.
8.2 Discuss the different strategies, approaches, process, levels, principles and indicators for women's empowerment.
8.3 Discuss the Gender statistics in India – Glaring inequalities.
8.4 Explain Women and Development
   8.4.1 List the Goals and Objectives of National Policy-2001 for Women's Empowerment.
   8.4.2 Discuss the emphasis given on the Advancement of Women through Five-Year Plans.
   8.4.3 List the Various Special Programs for Women's Development from government.
8.6 Case Studies.
MODEL QUESTION PAPER

FIFTH SEMESTER

BASIC MANAGEMENT SKILLS & INDIAN CONSTITUTION

Time: 3Hrs

Max marks: 100

Part-I is compulsory and Answer any two full questions from Part-II, Part-III, and Part-IV

PART- I

1. A) Fill in the blanks with appropriate words:-

I) The Constitution of India came into effect on _______________.

ii) The term of the chairperson of Rajyasabha is_________ years

iii) ________________ is an unforeseen event

5X1=5
iv) The ISO ____________ is related with Environmental management systems
v) Increased _______ leads to the benefits for both employer and employee

B) State the qualities of a good leader

PART-II

2 a) Explain SWOT analysis-Mention benefits of SWOT analysis
b) Explain special features of communication.
c) Explain Formal and informal communication network.

3 a) Explain the motivating factors
b) State the qualities of a good leader
c) Explain the process of team building

4 a) State the characteristics of entrepreneur
b) Lists the steps involved for setting up small scale/Medium scale industries
c) Define outsourcing and mention its features

PART-III

5 a) State the functions of Production planning and Production control
b) Define inventory and inventory control
c) State the importance of material management

6 a) Explain the total productive maintenance
b) List the various types of preventive measures to avoid an accident
c) List the factors affecting quality

7 a) Explain the concept of Total quality management
b) List the various types SQC tools
c) State the importance of material management

PART-IV

8 a) What is a constitution?
b) Why Dr. B R Ambedkar is known as architect of Indian Constitution?
c) What is sovereignty?

9 a) Why is there a need to Economic, social and political justice in India?
b) Explain three tier panchayath system
c) Mention the salient features of Indian constitution. 5
10 a) what are the approaches to empowerment of women? 5
 b) List the goals and objectives of national policy for women's empowerment. 5
c) Write a note on dowry prohibition act. 5

**Question Bank on Indian Constitution**

1. What is a government?
2. What is a constitution?
3. Why constitution is called the rule of the State?
4. Write the importance of the constitution.
5. To draft a constitution to India was the most challenging task. Why?
6. What are the contributions of Dr. B R Ambedkar in drafting a constitution for India?
7. What is the importance of republic day?
8. What is the importance of preamble?
9. Why is preamble said to be the soul of the constitution?
10. What is sovereignty?
11. What is the objective of Socialism?
12. The principle of Secularism is suitable to India. How?
13. Why is India called republic?
14. Why is there a need to Economic, social and political justice in India?
15. Mention the aspects which strengthen the bond of fraternity in India?
16. In the present context unity and integrity are most essential in India. Why?
17. Though Directive principles are not enforceable by law they are important in the constitution. How?
18. Mention the salient features of Indian constitution.
19. How is written constitution, advantageous than unwritten constitution?
20. Indian constitution is one of the lengthiest constitution. Mention the factors to substantiate the statement.
21. State the notable features borrowed from the following constitutions: a) U. S. A.
   b) England  c) Ireland  d) Canada.
22. Why is Indian constitution termed as flexible constitution?
23. What is universal Adult Franchise?
24. Write the advantages of single citizenship.
25. Why is Indian judiciary said to be an independent judiciary?
26. What is the importance of Fundamental rights?
27. How can it be said that Fundamental rights are not absolute?
28. Mention the Fundamental rights.
29. Give reasons as to why certain sections of the society are provided concessions and privileges in spite of right to equality.
30. How does cultural and educational right protect the interests of the minorities?
31. Mention the right introduced in 2010 under right to equality what is the importance of it?
32. Name the right that bans child labour and provides protection to women against exploitation.
33. The right to Constitutional remedies is said to be the heart and soul of our constitution. Why is it said so?
34. Rights and Duties are like the two sides of the same coin - Substantiate the statement.
35. Mention a few fundamental duties that you have to follow as a citizen of this country.
36. When and in which the fundamental duties part of the constitution was incorporated?
37. Name the body that has powers to amend the provisions of the constitution in India.
38. What is the procedure followed in parliament to amend the provisions of Fundamental rights and Directive principles?
39. Write the procedures to be followed to amend the constitutional provisions.
DIPLOMA IN MECHANICAL ENGINEERING
(WELDING & SHEETMETAL TECHNOLOGY)

Fifth Semester

Sub: COMMUNICATION AND ANALYSIS SKILL DEVELOPMENT PROGRAMME (CASP)

HOURS/WEEK: 06 TOTAL HOURS: 96

Competence to be developed in learners:

I. To present orally any topic of the student’s interest to the rest of the class without the assistance of media or any other aid (only talk) for at least 10 minutes creating interest in the listeners and sustaining the interest with a meaningful conclusion.

II. To prepare a study report on any product/service in comparison with another one that is comparable from technical specification to customer satisfaction.

III. To present with the aid of slides (6 to 10) about the study conducted above to the rest of the class in about 10 minutes with the use of print for information and slides for graphs, pictures, images, video and animations etc.

Note to teachers:

- A teacher may guide only 6 to a maximum of ten students per year. This is to ensure active participation of each learner.
- All 96 hours need NOT be contact hours by the teacher. Students may be encouraged to do activities on their own with peer group to ensure higher level of participation.
- There are ten different tasks to be completed in the course of 96 hours. On completion of each task, record the result and the marks along with the initials of the learner for future reference, inspection and evaluation.
- A few activities are suggested under each task. Teachers can improvise on the list and add more activities as they progress from one batch to another.
- Students should not be compared with each other; instead they must be compared to the standards given against each task.
- The standard suggested is minimum requirement, learners may excel. The services of those who excel may be utilised to guide other learners to reach the suggested minimum.
- The tasks 8, 9 and 10 may be evaluated in the presence of the total group so that learners get the benefit of knowing the inferences made by others and even their presentation style.

Details of tasks must be completed:
(One group consists of maximum 6 nos.)

Task 1 – Communication skills (one to one communication). 6 hrs. 5 marks.

Method of achieving task: Practice in pairs through role play

Suggested activities:
1. Telephonic conversation of a customer and supplier.
2. An Automobile show room person and a customer.
3. Negotiation between Machine tool manufacturers and a technical representative at a polytechnic
4. Conversation between quality inspectors and the production supervisor of shop floor

Regarding producing quality components

Standards to be met:
- Given a telephone number, a student must be able to call and gather information from the person, sustaining the conversation for about 3 min using proper etiquettes and report on the enquiry made about the product or service. [e.g., call a toll free number to ask details about a product or service]
- Given a situation, a student must be able to talk to a person face to face in simulation, gather information about a product, discuss about it and also negotiate with him in the specified time (here, time can be specified by the teacher as per the need).

Task 2 – Communication exercise (one to many in simulation) 6 hrs. 5 marks.

Method of achieving task: Student should pick a topic and make presentation

Suggested Activities:
1. A very short talk highlighting the features of a two wheeler
2. A creative advertisement sequence for a consumer product being eco friendly.
3. A debate on increasing the productivity for a manufacturing industry.
4. A panel discussion among students on issues related to cellular manufacturing.

Standards to be met:
- Given a brochure, one must be able to study about the product and understand it in 15 min and talk about it to his group highlighting its features and explain it in about 3 min.
- A student must be able to identify a topic of interest for debate, initiate the debate and carry it on, dividing the group into two based on different perspectives (e.g., For and against the topic)

Task 3 – Listening Skills: 6 hrs. 5 marks.

Method of achieving task: Listen to an advertisement and record the message

Suggested Activities:
1. View an advertisement of a branded product and write down the message behind.
2. Listen to the audio in a promotional CD for about 15 minutes of any chosen product or service. Note down points and discuss among friends.
3. View a CD of an innovative safety practice observed in manufacturing industry for 15 minutes and write down the summary in a paragraph of 20 lines.
4. Listen to a lecture on environmental effects of Thermal power plants and nuclear power plants and write a summary in 200 words.

Standards to be met:
• Given an audio clip or a visual of an advertisement, one must be able to listen carefully and understand it enabling him to write the message behind it in the specified time (say in about 5 min.).
• A student must be able to listen to a lecture or watch a CD for 15 min, noting down the key points and write a summary in 200 words in the next 15 min. 
  **Note:** Hints taken and the summary must be hand written by the student and documented for evaluation.

**Task 4 – Reading skills:**  
6 hrs. 5 marks.

*Method of achieving task: Read literature and make presentation*

*Suggested activities:*

1. Read an article from a magazine about the concept of Just in time and supply chain management techniques in production industry in order to control the inventory and talk to the rest of the group in about 5 minutes.
2. Read an advertisement of a new released four wheeler by company and elaborate its qualities after collecting information from a different source like the company web site and a few customers.
3. Read an article on designing using CAD from the internet and discuss the merits.
4. Read an article on ERP packages from the internet and discuss the merits relevant to industry
5. Read a note on usage of automated material handling system and storage retrieval system from any technical journal and narrate in the class.

*Standards to be met:*

- Given an article from a journal or an advertisement from a magazine, one must be able to comprehend it in 15 to 20 min. Later on read it out to an audience, with proper intonation and elaborate it in the next 10 min.
- Given an article from the internet, a student must be able to gather more information from the net about it, understand it and read it out for an audience and narrate it.

**Task 5- Writing Skills:**  
12 hrs. 10 marks.

*Method of achieving task: Prepare a resume in writing& highlighting the skill sets*

*Suggested activities:*

1. Write a resume and a covering letter for three different jobs
   1) Wanted skilled technician for a fabrication industry.
   2) Wanted technician who is proficient in 3D Modeling for a MNC.
   3) Wanted Service Supervisor for Automobile show room
2. Write a synopsis for given topics such as optimizing the machining parameters for alloy steel in 100 words.
3. Write a summary on latest style & features in domestic washing machine and refrigerator as house hold products.
4. Write an essay on any topic related to Mechanical/Automobile/Mining area for 150 words.

*Standards to be met:*

- Given a reading material from a journal or an advertisement from a magazine, one must be able to write it in 15 to 20 min. Later on read it out to an audience, with proper intonation and elaborate it in the next 10 min.
- Given a reading material from the internet, a student must be able to gather more information from the internet about it, understand it and write it out for an audience and narrate it.
Given a job advertisement, a student must be able to write a suitable resume and a covering letter in 30 min [Advertisements can be tailor-made by the teacher deliberately to train their students- e.g., two different jobs like a marketing person and an assistant in a Research & Development section and train students to prepare two resume for these jobs highlighting different achievements of the student in co-curricular activities to suit each job].

Given a topic, a student must be able to write a synopsis or summary or an essay in about 150 words in the stipulated time.

Note: All these have to be hand written by the learner and documented for evaluation.

Task 6- Knowledge of using Internet: 6 hrs. 5 marks.
Method of achieving task: Use the internet and perform the task identified
Suggested activities:
1. Create an e-mail id and mail to 6 others
   1) Sending simple messages
   2) Forwarding messages with their comments.
2. Sending message with attachments
   1) Adding files as attachments
   2) Adding scanned attachments.
3. Collecting data from net
   1) Advanced welding practices available for underwater applications
   2) Computer aided process planning
4. Forwarding resumes to different jobs.

Standards to be met:
- Given an access to internet, one must be able to create an email ID, send mails, forward simple mails and also mails with attachments including scanned attachments and URL (web addresses for direct link). Also, they must be able to collect data from different websites using internet search engines and forward resumes to different job offering companies.

Note: Printouts of the mails, replies received and also the attachments with date and time have to be documented.

Task 7- Oral communication: 12 hrs. 5 marks.
Method of achieving task: Conduct group discussion on a specific topic and record the discussions
Suggested activities:
1. Debate on current topics like Total quality management
2. Group discussion on latest developments in Fabrication and machining areas.
3. Discussion on qualities required for good entrepreneur.
4. Debate on role of women in managing the industry.

Standards to be met:
- Given a topic of relevance, they must be able to form groups and discuss/debate on it. Also one must take cue and participate actively in a group discussion.
Encourage students to note down the points of discussion and file the points in the portfolio for evaluation.

**Task 8- Data analysis:** 18 hrs. 10 marks.

*Method of achieving task: Collecting data and analyzing for meaningful inferences.*

**Suggested activities:**

1. Collect data for any two products/machines of two different producers used in manufacturing industry which includes technical details, specifications, cost and customer satisfaction.
2. Use appropriate tools and collect data from authentic sources. Depending on the source decide the number of units for collecting the data.
3. Analyze the data with a view to compare the two products/machines.
4. Interpret the analysis for meaningful conclusions.
5. Record the whole process for any other person to verify.

**Standards to be met:**

- Given two products/equipments/service, one must collect adequate information from an authentic source for each, like the company website or the printed brochure and record the specifications.
- The maintenance of quality of the product/service needs to be studied from personnel working at different levels in the company (3 -5 in number) for each product/service. A set of questions needs to be prepared for collecting data. The same questionnaire has to be used for collecting data from the personnel mentioned above.
- One must compare the two products for all the parameters based on the specifications. Also, a market survey has to be done preparing a printed questionnaire of around 5 questions and collecting responses from 20 customers. Then, analyse the data, compare them and interpret the analysis for meaningful conclusions.

**Note:** This being a comprehensive task may require few weeks to finish. The data collected and the analysis carried out need to be documented.

**Task 9-Presentation Skills:** 12 hrs 10 marks..

*Method of achieving task: report the data collected and analysed through task 8.*

Student should present the analyses, interpretation and inferences of activities undertaken in Task 8 for about 10 minutes supported by few slides (6 to 10) of pictures, graphs and images. The text material if any may be printed and given to the audience. Discourage students from using text material in slides.

**Standards to be met:**

- One must present the analysis done in task 8 using slides with pictures, graphs, images etc in 10 min. The first slide may contain text only as per need but other slides should preferably have pictures and images. Usage of graphs for comparison and analysis is preferred. Text materials have to be given as handouts to the audience.
Task-10- Pick & Speak: 12 hrs. 5 marks.

Method of achieving task: Pick and speak on any topic

Suggested activities

Pick a topic from a lot and student should be allowed to speak for the duration of 3 to 5 minutes without the aid of any other media.

Standards to be met:

- One must be able to talk extempore for 2 min on any topic picked randomly from the lot, given a time of two minutes for organising his/her thoughts. The topics can be kept simple and general (current events of interest like cricket or tsunami). It must be totally an oral activity without the aid of any other media.

Suggested topics for presentation, discussion, and written & other related tasks.

- Window air conditioner
- Composite materials
- Hydrogen as alternative fuel
- Lean manufacturing
- Power plant safety
- Alternative materials for manufacturing
- Laser beam welding
- Welding for Medical applications
- Quality certification standards
- Latest Mining equipment’s
- Comfort air conditioning systems
- Time and Method study
- Industrial Waste disposal
- Preventive maintenance
- Industrial safety
- Micro machining
- Aluminium castings
- Advantages of design work stations
- Ultrasonic machining
- Laser beam machining
- Plasma arc welding
- CNC cutting tools
- Total productivity maintenance
- CNC Milling and Turning centers
- Fluid power couplings

FORMAT OF LOG SHEETS *

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<tr>
<th>Sl.No.</th>
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<th>Task</th>
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<th>Evaluation (as suggested in each task)</th>
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All documented work as described in each task need to be filed in a portfolio with task no.1 at the bottom and task 10 on top.

The log sheet may be filed on top.

Learners need to have only one portfolio which contains all original documents. Duplicate copies need not be maintained. This is to ensure the authenticity of data collected and the analysis conducted on the data.

SCHEME OF EVALUATION
(Total no. of students in one batch for end examination should not exceed 10)

1. Maintenance of portfolio & log book.                                                        10
2. Evaluation of prepared report on all ten tasks                                    65
3. End examination:
   A portfolio evaluation is recommended for the end examination evaluating the record of all ten activities of each individual learner for consistency and in case of any discrepancy the learner may be assessed on the criteria given against each task.
   Marks awarded for evaluating the portfolio -                                          50
   Total= 125.

Note to End examination evaluators:

- Check the genuineness and authenticity of all recorded activities in the portfolio.
- The learner may be asked to do one activity of the choice of the examiner which involves listening to instructions, writing a small paragraph of 50 words, reading it and talking for a few minutes.
- The learner may be asked about his satisfaction of the marks awarded and in case of any mismatch the examiner may assess his performance and alter the portfolio assessment (here the benefit of doubt may be in favour of the learner i.e., an improvement may be recorded but in case the examiner feels that the marks awarded is more the same may be retained).
- Do not compare the performance of one student with that of another.
- Always compare the performance of a learner to the given standard.
- Total time taken for the evaluation of a portfolio need not exceed 15 minutes.

Recommended text book for the prescribed syllabus:
Ashan Academy (2011), Communication and Analysis skills, Orient Blackswan, Hyderabad.

References:


In case during the implementation of CASP any teacher has a suggestion to improve the learners competence concerning any one of the ten tasks please feel free to mail to the following addresses: 1) jointdirector.cdc@gmail.com or 2) ecb@vsnl.net
COURSE CONTENT

SECTION 'A'

1. Introduction to Machine drawing
   1.1. Machine design
   1.2. Design procedure
   1.3. Properties of material
   1.4. Design considerations
   1.5. Codes and standards
   1.6. Factors influencing the selection of a suitable material for a machine element.

2. Design of Riveted joints
   2.1. Rivet, Riveting
   2.2. Caulking and Fullering
2.3. Rivet heads
2.4. Types of Riveted joints. Merits of riveted joints
2.5. Terminology
2.6. Failure of Riveted joints
2.7. Strength of joint
2.9. Riveted joints for Boiler or pressure vessels
2.10. Design of boiler joint- Design of longitudinal joint and design of circumferential joints
   a. Design procedure for longitudinal joints
   b. Design procedure for circumferential joints
2.11. Structural joints
2.12. Problems on longitudinal joint and circumferential joint and structural joints

2.0 Design of welded joints
   2.1 introduction to welded joints
   2.2 Types of welded joints
   2.3 Strong of butt welds, Lap or Fillet welds, Transverse (normal) fillet weld, combines parallel and transverse fillet weld.
   2.4 Welded joint subjected to static and fatigue loading
   2.5 Axially loaded unsymmetrical welded section
   2.6 Welded joint- Eccentric loading
      2.6.1 Welds subjected to bending
      2.6.2 Welds subjected to Torsion
   2.7 Advantages of welded joints over riveted joints
   2.8 Solve problems on welded joint under static and dynamic loading, Axially loaded unsymmetrical welded sections, welding subjected to torsion and bending.

\SECTION 'B'

3.0 Sheet metal drawing
   3.1 Types of sheet metal joints
   3.2 Different methods of design and development of sheet metal components
   3.3 Development of component of shape cubes, prisms, cylinders using parallel line method
   3.4 Development of pyramid, conical shaped component using radial line method
   3.5 Development of components of transition pieces, connecting ducts, pipes and opening of different shapes using triangular methods.
   3.6 Development of double curved surfaces such as spheres, parabolic etc. using approximate method
   3.7 Combination method of development, such as round to square, square to conical, conical to sphere etc.

4.0 Welding Drawing
4.1 Types of welded joints with edge preparation
4.2 Types of pipe joint
4.3 Standard location of elements of welding symbols
4.4 Welding symbols
4.5 Design and joint details of column splices, column base and column seals
4.6 Design and joint details of trusses like mill roof, fink roof

REFERENCE BOOKS

Design of Machine Elements I
1. TBK Das & P. L Srinivas murthy

Design of Machine Elements
2. R.S. khurmi and J.K. Gupta
SCHEME OF EXAMINATION
PAPER SETTING

Section I
Theory & Design Problems on Welded Joint & Riveted Joint
Set 3 questions each carries 30 Marks
(Answer any 2)
60 marks

Section II
Drawing on Welded Joint & Riveted joint
Set 3 Questions each carries 20 Marks
(Answer any 2)
40 marks
ESTIMATION AND COSTING

Subject Title : Estimation and Costing
Subject Code :
Hours Per Week : 04
Hours Per Semester : 64

TOPIC ANALYSIS

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<th>Major Topics</th>
<th>Hours Alotted</th>
<th>Weightage of Marks</th>
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<td>Introduction to Estimation and costing</td>
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<td>Elements of costs</td>
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<td>Mechanical estimation</td>
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<td>PART-C</td>
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<td>Wages and incentives</td>
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OBJECTIVES

On the completion of the course the students should be able to:

1. Understand the estimation and costing procedure in industries
2. Know the actual costing process and calculation of selling prices
3. Understand the depreciation of equipments, plants and to know the different methods of calculating depreciation
4. Know the procedure for calculating material cost of various components
5. Understand the procedure for estimation of various shops
6. Know the labour wages and incentives
7. Know about basics of financial management
8. Understand the concepts of project planning and breakeven analysis

1.0 Introduction to Estimation and costing

1.1 Estimation - Definition, Importance and Aims
1.2 Qualities and functions of an Estimator
1.3 Source of errors in estimation
1.4 Constituents of Estimation
1.5 Costing - Definition and Aims
1.6 Standard cost and its Advantages
1.7 Difference between estimation and costing
1.8 Advantages of efficient costing

2.0 Elements of costs
2.1 Elements of cost - material, labour, expenses
2.2 Material - Direct material, indirect material and examples
2.3 Calculation of Material cost
2.4 Labour - direct, indirect labour and examples
2.5 Calculation of labour cost
2.6 Expenses - direct, indirect expenses and examples
2.7 Classification of expenses - factory, administrative, selling and distribution expenses and examples
2.8 Fixed and variable expenses and examples
2.9 Components of cost - prime cost, factory cost, office cost, total cost
2.10 Selling price
2.11 Block diagram to show the relationship between elements and components of cost
2.12 Simple problems on above
2.13 Allocation of on-cost - methods and simple problems

3.0 Indirect expenses and depreciation
3.1 Indirect expenses - depreciation, obsolescence, inadequacy, idleness, repair and maintenance
3.2 Depreciation - causes, methods of calculating depreciation
3.3 Simple problems on each method

4.0 Mensuration and Estimation of material cost
4.1 Area of regular plane figures
4.2 Volume and surface area of solids (formulae only)
4.3 Estimation of material costs of step pulley, spindle lathe centre, Rivets, Fly wheel, Crankshaft, Chain link, Wedge and Gib-headed key,

5.0 Mechanical Estimation
5.1 Estimation in machine shop - Definition of cutting speed, feed, depth of cut
5.2 Estimation of time for various operations like Turning, Knurling, Facing, Drilling, Boring, Reaming, Threading, Tapping, Milling, Grinding, Shaping and Planning
5.3 Estimation in sheet metal shop - Sheet material and gauge number, Sheet metal joints, Select suitable formula for estimation
5.4 Estimate the material required for preparation of container open on one side
Cylindrical drum, funnel and tray

5.5 Estimation in foundry shop-pattern allowances, estimation of pattern cost, simple problems on C.I pulley and C.I. Wheel

5.6 Estimation in welding shop - estimation of gas welding cost, estimation of arc welding cost - Simple problems

6.0 Wages and incentives

6.1 Definition of wages, normal wages, real wages, living wages, fair wages, minimum wages, methods of wage payment

6.2 Incentives - definition of incentive, types of incentives, examples

6.3 Characteristics of a good wage and incentive systems

6.4 Standard time - work measurement

6.5 Bonus system - collective bonus system, group bonus system

7.0 Introduction to financial management

7.1 Definition of terms such as assets, liabilities, current and long term assets and liabilities, capital, income, expenses, gain

7.2 Working capital - definition - net and gross working capital - factors affecting working capital.

7.3 Maintenance of accounts through journal ledger, cash book, balance sheet.

7.4 Transaction with bank - credits, payments overdraft, current account, securities.

8.0 Project planning and Break even analysis

8.1 Concept of project work

8.2 Project planning like market survey, project capacity, selection of site, plant layout, product design, drawing, specification, material requirement operation planning,

8.3 Break even analysis - break event chart, diagram to illustrate break event point, Simple problems on break even analysis

SPECIFIC INSTRUCTIONAL OBJECTIVES

1.0 Introduction to Estimation and costing

1.1 Define estimation

1.2 Explain the importance of estimation

1.3 List the aims of estimation

1.4 List the qualities of Estimator

1.5 List the functions of Estimator

1.6 Classify the source of errors in estimation and explain avoidable and unavoidable errors with example
1.7 Mention the constituents of Estimation, explain time allowances only
1.8 Define costing and state its aims
1.9 Define Standard cost and state the advantages of standard cost
1.10 List the differences between estimation and costing
1.11 State the advantages of efficient costing

2.0 Elements of costs

2.1 Mention the elements of cost- material, labour, expenses
2.2 Define: Direct material, indirect material with examples
2.3 Calculation of material cost: Direct material cost and indirect material cost
2.4 Define: direct, indirect labour with examples
2.5 Calculation of labour cost: Direct labour cost and indirect labour cost
2.6 Define: direct, indirect expenses and examples
2.7 Classify indirect expenses-factory, administrative, selling and distribution expenses and examples
2.8 Explain Fixed and variable expenses and examples
2.9 Explain the Components of cost-prime cost, factory cost, office cost, total cost
2.10 Explain Selling price
2.11 Draw the Block diagram to show the relationship between elements and components of cost
2.12 Solve Simple problems on above
2.13 Explain the allocation of on-cost- methods and simple problems

3.0 Indirect expenses and depreciation

3.1 Explain indirect expenses- depreciation, obsolescence, inadequacy, idleness, repair and maintenance
3.2 Define depreciation and state its causes, (Physical and functional)
3.3 Explain methods of calculating depreciation
3.3 Solve simple problems on each method

4.0 Mensuration and Estimation of material cost

4.1 Mention Area of irregular and plane figures with sketches
4.2 Mention Volume and surface area of solids (formulae only)
4.3 Estimate the material costs of step pulley, spindle lathe centre, Rivets, Fly wheel, crankshaft, chain link, wedge and Gib-headed key-Simple problems only

5.0 Mechanical Estimation

5.1 Estimation in machine shop-Define cutting speed, feed, depth of cut
5.2 Estimate the time for various operations like turning, knurling, Facing, Drilling, Boring, Reaming, Threading, Tapping, Milling, Grinding, shaping and planning -Simple problems only
5.3 Estimation in sheet metal shop - explain sheet material and gauge number, Sheet metal joints, select suitable formula for estimation
5.4 Estimate the material required for preparation of container open on one side, Cylindrical drum, funnel and tray (Simple problems)
5.5 Estimation in foundry shop - explain pattern allowances, estimation of pattern cost, simple problems on C.I pulley and C.I. Wheel
5.6 Estimation in welding shop-estimation of gas welding cost, estimation of arc welding cost (Simple problems)

6.0 Wages and incentives

6.1 Define: wages, nominal wages, real wages, living wages and fair wages Minimum wages and Mention methods of wage payment
6.2 Define incentives - Mention types of incentives with examples
6.3 List the characteristics of a good wage and incentive systems
6.4 Define Standard time and work measurement
6.5 Explain the procedure for work measurement
6.5 Explain bonus system - collective bonus system, group bonus system

7.0 Introduction to financial management

7.1 Define: assets, liabilities, current and long term assets and liabilities, capital, income, expenses and gain
7.2 Working capital - definition - Explain net and gross working capital - List the factors affecting working capital.
7.3 Explain the maintenance of accounts through journal, ledger, cash book,
7.4 Explain balance sheet.
7.5 Define: credits, payments, overdraft, current account, securities.

8.0 Project planning and Break even analysis

8.1 Explain the concept of project work
8.2 Explain: market survey, project capacity, selection of site, plant layout, product design, drawing, specification, material requirement operation planning,
8.3 Describe break even analysis - Draw break event chart, diagram to illustrate break event point, Solve simple problems on break even analysis

REFERENCES BOOKS

1. Mechanical estimation and costing- T.R.Banga and S.C.Sharma
2. Estimation and costing – by Acharya and Narang
3. Industrial Organisation and Engineering Economics by Banga and Sharma
DERPARTMENT OF TECHNICAL EDUCATION
DIPLOMA COURSE IN MECHANICAL ENGINEERING
SIXTH SEMESTER
MODEL QUESTION PAPER

ESTIMATION AND COSTING
Time: 3Hrs
Max marks: 100

Note: 1. Section-I is compulsory
2. Answer any six full questions from Section -II, Section-III, and Section-IV. Choosing at least TWO from each section

SECTION I
1 a) Fill in the blanks with appropriate words: - 1X5
   i) The expenditure which cannot be charged to particular product during production is known as _____________
   ii) The lubricating waste and the coolant used during production are ________ materials
   iii) Reduction in the value and efficiency of a machine or asset is known as _____________
   iv) The time counted from when the last element of operation has been completed is known as _____________
   v) The capital which is required to meet the day to day needs _____________

b) Write a note on pattern allowances 5

SECTION II
2 a) Explain avoidable and unavoidable errors with example 5
b) Define standard cost and mention the advantages of standard 5
c) State the advantages of efficient costing 5

3 a) Draw the Block diagram to show the relationship between elements and Components of cost 5
   b) A small firm is producing 100 pens per day. The direct material cost is found to be Rs 160, direct labour cost is Rs 200 and factory overheads are Rs 250. If the selling on cost is 40% of the factory cost, what must be the selling price of each pen to realise a profit of 14.6% of the selling price? 10

4 a) State the causes for depreciation 5
   b) An industrial plant with an initial value of Rs 2,00,000 and salvage value of Rs 20,000 at the end of 20 years were sold for Rs 1,45,000 at the 10 years. What is the profit or loss, if sinking fund depreciation at 8% compounded annually was adopted? 10
SECTION III

5 a) Mention the procedure for estimation of material cost.

5 b) Find out the weight of the 10 mild steel spindles as per the dimensions given in figure. Calculate the weight of scrap with their turned out from a mild steel rod of 25 mm diameter and facing and parting off allowances can be taken as 1 mm and 5 mm respectively. Assume that 15 mm length of rod is required for grip in the chuck. Density of ms is 7.8 gm/cc.

![Diagram of a component with dimensions: 25 mm width, 30 mm length, 10 mm height.]

10

a) Define cutting speed and depth of cut

b) Find the time required to turn a 60 mm dia rod to the dimensions shown in the fig. Take cutting speed as 20m/min feed 1.2 mm. All cuts are 3mm deep

7 a) Explain any two sheet metal joints with simple sketches.

5 b) A container open on one side of size 0.5X0.5X1m height is to be made from
plates of 6 mm thickness. Take density of plate metal as 8 gm/cc and joints are
to be welded. Estimate the cost of the container from the following data.
Cost of the plate = 30/kg
Sheet metal scrap = 5% of material
Cost of labour = 25% of material cost
Cost of welding material = Rs 20 / metre of weld

SECTION IV

8 a) Define working capital and mention the factors affecting working capital  5

b) Find the cost of 2000 C I pulleys as shown in the fig. Its surfaces are to be
machined after casting. The pattern is supplied by the customer. Following data
is to be used .
Cost of metal = Rs 20/kg
Moulds prepared by each worker = 20
Melting charges = 20% of metal cost
Machining allowance on each side = 2 mm
Wages of each moulder = Rs 160 / day
Density of cast iron = 7.2 gm/cc
Overhead charges = 25% of metal cost

9 a) Define wages and mention the types of wages.  5

b) Define incentives and explain different types of incentives with examples  5
c) Mention the characteristics of a good wage and incentive system.  5
10 a) Mention the steps involved in project planning 5
b) Draw a diagram to illustrate the breakeven point 5
c) Fixed costs in a factory is Rs 10000/ year and variable costs are Rs 2.00/ unit and selling price is Rs 6.00 / unit. Calculate the BEP 5

----------X----------

SCHEME OF EXAMINATION
Section I compulsory
1. a) Fill in the blanks- 05 marks
b) 05 marks
Section II, III, IV answer any two full question from each section 90marks
Total 100marks

PAPER SETTING
Section I
1. a) Fill in the blanks (from all chapter) 05 marks
b) 05 marks
Section II Set 3 question each carry 15 marks 45 marks
Section III Set 3 question each carry 15 marks 45 marks
Section IV Set 3 question each carry 15 marks 45 marks
| TASKS                                                      | RESOURCE NEEDED                                      | I    | II   | III  | IV   | V    | VI   | VII  | VIII | IX   | X    | XI   | XII  | XIII | XIV  | XV   | XVI  |
|-----------------------------------------------------------|------------------------------------------------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| Literature survey for project                            | Internet / library / industry / Research Centres     |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| Finalisation of the Area in which the project has to be done (Example: Design / Manufacturing / Thermal Engineering) | Internet / library / industry                        |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| Finding out Facility to do the project                   | Laboratory / Industry / Project Sites                |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| Collecting Data / Doing experiments / writing of code    | Laboratory / Industry / Project Sites                |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| Analysis of Data                                          | Using relevent software                              |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| Results and Fine tuning the experiment using the Data Analysis | Laboratory / Industry / Project Sites                |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| Report writing                                            |                                                      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| Submission of Project Report and Viva voce               |                                                      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
Contact Hrs/Week: 6 Hrs. 

As far as possible students should be given application oriented project problems with a view to:

1. Develop an understanding regarding the size and scale of operations and nature of field work in which students are going to play their role after completing the course of study in Mechanical Engineering.

2. Develop an understanding of subject based knowledge given in the classroom in the context of its application at workplaces.

3. Provide first hand experience to develop confidence amongst the students to enable them to use and apply acquired technical knowledge and skills to solve practical problems of the world of work.

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

5. Practical exposure to an industrial activity

For the fulfillment of above competencies, polytechnics may establish close linkage with 8-10 relevant organizations for providing such an experience. It is necessary that each organization is visited well in advance by respective teachers and activities to be performed by students are well defined. The chosen activities should be such which are of curricular interest to students and of professional value to industrial/field organizations.

**Each Project batch must have Minimum of 5 and maximum of 7 students.**

Effort should be made to identify actual field problems to be given as project work to the students. Project selected should not be too complex which is beyond the comprehension level of the students. The placement of the students for such a practical cum project work should match with the competency profile and interest of students.
Students may be assessed both by industry and polytechnic faculty.
The suggested performance criteria are given below:
a) Punctuality and regularity (Log book - mandatory and to be produced during IA verification)
b) Initiative in learning/Demonstration and fabrication of model
c) Level/proficiency of practical skills acquired
d) Originality
e) Scope for patentability
f) Sense of responsibility
g) Self-expression/Communication skills
h) Interpersonal skills.
g) Report writing skills
h) Viva voce
Some of suggested projects are given below: These are only guidelines, teacher may take any project related to Mechanical and allied area depending upon the availability of projects. Preference should be given to practical oriented projects.

1) Industrial Visit
Students are required to undergo an industrial visit for period of at least 3(Three) working days, either in V/VI semester. After completion of their visit the reports should be prepared. Each Student should write the report independently in view of his own observation in industry. All days for the visit should be accounted for clearly giving attendance particulars. The concern accompanying staff is to check student presence and access progress periodically

1.1 Industrial report
Students are required to submit a comprehensive report on factory visit with details of the organization where the training was undergone. The comprehensive report should focus on study of plant/ product /process/ along with intensive in-depth study on anyone of the topics such as processes, methods, tooling, plant layout and equipment, highlighting aspects of quality, productivity of the system. Any data, drawings etc should be incorporated with the consent of the Organization. The comprehensive report should be submitted for the end exam for evaluation.

2) Project work
According to the local needs, the following major projects are suggested:
1. Non-conventional energy
   - Low Cost Solar Water Heating System for Domestic Purpose
   - Fabrication of Solar cooker
   - Study of Community Biogas Plant
   - Fabricate a thermally efficient wood burning stove
   - Solar lamps
   - Solar powered refrigerator

2. Mechatronics/Material handling area
   - Motorized object lifting jack
   - Key controlled- fork lifter
   - Object counting machine
   - Stepper motor control with selected steps for conveyor belts
   - Robotic arm with gripper
   - Material handling device in X,Y,Z motion control
   - Robotic crane
   - Robotic trolley for material handling

3. Fluid power and control area
   - Pneumatic/Hydraulic jack
   - Pneumatic/hydraulic crane
   - Pneumatic/hydraulic Presses
   - Air compressed spray gun
   - Pneumatic transport system

4. Automobile related area
   - Regenerative braking system
   - Steering controlled headlight
   - Engine/motor vibration checker
   - Seat belt automatic locking system
   - Hydraulic braking
   - Electromagnetic shock absorber
   - Digital auto speed limiter

5. Motorized wheel chair
6. Fabrication of various types of lathe attachments
7. Repair and overhauling of various machine tools and lab equipments available at polytechnic
8. Critical Study of existing quality systems and inventory control at industry
9. Mechanical industry fabrication related projects
10. Automatic mopping machine to clean the floor area
11. Automatic milling machine with digital control
12. PCB fabrication
13. Any study project related to Mechanical and allied areas in industry
14. Any project related to industry based problems
15. Any projects related low cost automation

The Project Report should consist of following items.

1. Introduction
2. Review of Literature
3. Study Area
4. Methodology/Design/fabrication/Tests
5. Result and Discussion
6. Conclusion and scope for future study
7. References.

GUIDELINES FOR THE PREPARATION OF PROJECT REPORTS

1. Project reports should be typed neatly in Times New Roman letters with font size 14 for titles and 12 for text on both sides of the paper with 1.5 line spacing on a A4 size paper (210 x 297 mm). The margins should be: Left - 1.5", Right - 1", Top and Bottom - 0.75".

2. The total number of reports (Soft bound) to be prepared are
   ➢ One copy to the department
   ➢ One copy to the concerned guide(s)
   ➢ One copy to the candidate.

3. Before taking the final printout, the approval of the concerned guide(s) is mandatory and suggested corrections, if any, must be incorporated.

4. Every copy of the report must contain
   ➢ Inner title page (White)
Outer title page with a plastic cover

Certificate in the format enclosed both from the college and the organization where the project is carried out.

An abstract (synopsis) not exceeding 100 words, indicating salient features of the work.

5. The organization of the report should be as follows

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Chapters (to be numbered in Arabic) containing Introduction-, which usually specifies the scope of work and its importance and relation to previous work and the present developments, Main body of the report divided appropriately into chapters, sections and subsections.

The chapters, sections and subsections may be numbered in the decimal form for e.g. Chapter 2, sections as 2.1, 2.2 etc., and subsections as 2.2.3, 2.5.1 etc.

The chapter must be left or right justified (font size 16). Followed by the title of chapter centered (font size 18), section/subsection numbers along with their headings must be left justified with section number and its heading in font size 16 and subsection and its heading in font size 14. The body or the text of the report should have font size 12.

The figures and tables must be numbered chapter wise

The last chapter should contain the summary of the work carried, contributions if any, their utility along with the scope for further work.

Reference or Bibliography: The references should be numbered serially in the order of their occurrence in the text and their numbers should be indicated within square brackets for e.g. [3]. The section on references should list them in serial order in the following format.


Only SI units are to be used in the report. Important equations must be numbered in decimal form for e.g.

\[ V = IZ \] \quad (3.2)

All equation numbers should be right justified.

Separator sheets, used if any, between chapters, should be of thin paper

**NOTE:** 1. The candidate declaration and certificate sample copy are enclosed here for incorporation in final project report.

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**I A Marks:**

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**NOTE:** 1. Sesional marks to be awarded at the end of *EACH SEMESTER ONLY*

2. The candidate declaration and certificate sample copy are enclosed here for incorporation in final project.
CANDIDATE’S DECLARATION

I, ------------------------------------------ a student of Diploma in -------------------------------
Department bearing Reg No----------------------------------of -------------------------------
----- hereby declare that I own full responsibility for the information, results and conclusions
provided in this project work titled “---------------------------------”
------ “submitted to State Board of Technical Examinations, Government of Karnataka
for the award of Diploma in -------------------------------.
To the best of my knowledge, this project work has not been submitted in part or full elsewhere
in any other institution/organization for the award of any certificate/diploma/degree. I have
completely taken care in acknowledging the contribution of others in this academic work. I
further declare that in case of any violation of intellectual property rights and particulars
declared, found at any stage, I, as the candidate will be solely responsible for the same.

Date:

Place: candidate

Signature of Name: -----------------

Reg No-----------------
CERTIFICATE

Certified that this project report entitled ------------------------------------------
----------------------------------------------------------------------------------------
which is being submitted by Mr./Ms. ........................................., Reg. No............... , a bonafide student of ........................................ in partial fulfillment for the award of Diploma in ---------
---------Engineering during the year ...................... is record of students own work carried out under my/our guidance. It is certified that all corrections/suggestions indicated for internal Assessment have been incorporated in the Report and one copy of it being deposited in the polytechnic library.

The project report has been approved as it satisfies the academic requirements in respect of Project work prescribed for the said diploma.

It is further understood that by this certificate the undersigned do not endorse or approve any statement made, opinion expressed or conclusion drawn there in but approve the project only for the purpose for which it is submitted.

Guide(s)
Name and signature

Examiners
1
2

Head of
Department

Dept. of -------------------------
ROADMAP FOR PROJECT GUIDES

1. The project work is proposed to be carried out during the V and VI semesters so that learners prepare during the V semester, do some field work based on the preparation during the mid-semester vacation and report the analysis and inferences during the VI semester.
2. The learners would reach a level of maturity by the time they reach V semester and so a meaningful project lasting for a year can be executed by them.
3. To execute the project with involvement needs constant guidance and monitoring of the progress of the learners by the guide.
4. This does not mean teacher has to advice learners.
5. Be confident about the ability of the learner and “intellectually provoke” them with challenging questions. These questions should prompt the learners to search information and update themselves (to be carried out during the first two weeks).
6. Do not feed information to learners. Instead create a ‘cognitive dissonance’ (a challenging question or situation that the learner is not able to find an immediate answer but feels the need to search for information to find a solution).
7. Defer judgement on learners and give them identified sources if required like a journal article, book or a web site.
8. Even if the learners report their inability to solve do NOT give or prescribe a solution.
9. Be patient and give time for the learner to construct his knowledge.
10. Give corrective feedback to the learner by challenging his solutions so that his logic is questioned and it develops further.
11. This leads to the first activity viz., literature survey and conceiving a project.
12. During this phase meet the project team in a group and create a healthy competition among the learners to search different sources and synthesise their findings in the group.
13. Aim for bringing out a workable innovative project conceived within the first eight weeks as given in the schedule attached.
14. During these two phases and the third phase the teacher should assess the strengths and weakness of the members of the group and allocate differential work to team members on the remaining tasks to be carried out during the next thirty weeks.
15. This is to ensure active participation of all the members of the team.
16. By the end of the twelfth week finalise the project and a schedule of further activities for each member indicating the time frame in which his activities are to be executed may be made ready. A soft copy of this schedule may be collected from each learner by the guide to follow up.
17. This schedule prepared by each learner need to be documented for checking further progress of the project.

18. The next few phases of the project may require active guidance of the guide especially regarding the sources of collecting data, if a sample data is to be collected the number of units has to be decided, collating the data/fabricating, tryout/analysis and finally coming out with meaningful conclusions or models or application.

19. Data like models, designs, technical specifications, source code, protocols and original records need be collected from one authentic source as there will not be any variation. The teacher may guide the learners to authentic source.

20. Data having limited variability like product/service quality, processes and standards, procedures need to be collected from a sample as there is a variation. The number of units from whom (source) the data is to be collected is called sample. The sample needs to be representative of the expected variation. The decision on the size of the sample and the number of units need guidance from the teacher. For example, data regarding the quality of a product/service need be collected from 3 to 5 personnel at different levels of a service provider or dealers of a product. The numbers given are suggestive but a guide based on his experience has to make valid suggestions.

21. Data having a wide range of variation like customer satisfaction where the customers are members of the public need a larger number of units to accommodate the diversity. A tool like questionnaire with predetermined questions need to be prepared, tried out on a small sample and finalise the questions. Data may be collected from at least 30 units. This number is suggested to apply statistical analysis for meaningful conclusions. Guides may decide on the sample size depending on the accessibility of data.

22. The intention of the above three points viz., 19, 20 and 21 is to ensure objectivity in data collection i.e., to reduce the subjectivity of the human mind.

23. All the above activities need to be completed before three to four weeks before the end of V semester (refer the spread sheet related to scheduling).

24. The learners may be instructed to collect data objectively with identified sample during the next 4 to six weeks which includes the mid semester holidays. This would enable the learners to visit the field and collect data without the constraint of reporting to institution and attending classes on a regular basis.

25. The collected data need to be organised and entered to spread sheets or similar formats for analysis. Qualitative data may be converted to quantitative using a rating scale or similar data organisation procedures.

26. The result of most analysis on spreadsheet could be obtained in tables or graphs as per the requirement.

27. Activities mentioned in points 24, 25 and 26 may be carried out by learners during 4 to 8 weeks after commencement of VI semester.
28. Interpretation of the analysed tables and graphs to arrive at meaningful inference. The guide at this stage may defer his ideas on interpretation allowing the learners to do this. In case the learners err in the process they may be given corrective feedback.

29. A report of the whole process of doing the project may be written, word processed and submitted in triplicate.

30. Guides may contact industries and try to solve their problems so that the learners get a field experience and they get ready for the industry.

31. Innovations and innovative practices may be encouraged among the learners to be pursued as a project. Developing prototypes, (in simulation or real) trying out feasibility of new ideas, changing existing systems by adding modules, combining, assembling new modules and developing new systems may be given higher priority over routine bookish projects.

32. The schedule of events proposed is for an investigative project as a model. Guides may alter the prescribed schedule to suit the kind of innovative projects sited in point No.31 above.

33. Industry personnel may be involved in conceiving, executing and evaluating projects. This gives credibility to the institute and acceptance of learners for absorption into the company.

GUIDELINES TO LEARNERS TO CARRY OUT A TWO SEMESTER PROJECT

1. Carry out the project work through the V and VI semesters. Preparation must be done during the V semester and based on this, field work should be done during the mid semester vacation and reporting of analysis and inferences should be done in the VI semester.

2. You have the ability and the level of maturity needed to conceive an innovative and meaningful project accomplishing which gives you recognition by the industry and empowers you with the power of knowledge.

3. Understand your strength and weakness and make an effort to find the strength and weakness of other peers in the team.

4. Complement each other’s strength rather than compete with peers within the team. This will enable you to complete a comprehensive and innovative project relevant to the industrial needs rather than doing a routine copy of what others have done.

5. Seek guidance from the teacher and update him/her about the progress.

6. Be confident about your ability and that of other members of your group. Take extra efforts to collect information, share with your peers and synthesise your knowledge.

7. Question everything including the ideas of your teacher. Accept the ideas and instructions which are internally consistent (logical).

8. Involve actively in group activities and contribute towards the tasks.
9. Do not depend too much on the teacher as a source of information, search on your own and build your knowledge structure. Search for authentic sources like journal articles, books and authentic sites rather than blogs and tweets.

10. Though brief, record your thoughts and activities including searches immediately.

11. Prepare a schedule for your work on a spread sheet and encourage your peers to do the same.

12. Show your schedule and that of others to the teacher and get his feedback.

13. Keep reviewing the schedule every fortnight and take corrective steps if needed. For doing this keep the general guideline schedule given in the curriculum as a backdrop.

14. Tools used for data collection like instruments, testing machines, questions to be asked and software may be tried out and standardised by the twelfth week of the project. Seek the teacher’s help who is experienced in doing this.

15. Collect data dispassionately or objectively (without applying your personal prejudice). Complete this task before the VI semester begins.

16. While entering data into the spread sheet ask your peer member to verify. This will ensure accuracy of data entry.

17. Use appropriate mathematics/statistics for calculations. Seek help from external sources (other than your teacher) if required.

18. The results of your analysis need to be graphically represented and documented. You may also add photographs and video clips to increase the validity.

19. This task needs to be completed within 8 weeks after commencement of VI semester.

20. Interpret the data (after analysis) and arrive at meaningful inferences on your own in discussion with your peers. Get it ratified by your teacher. Suggestions from the teacher may be discussed among your peers and incorporated if they are internally consistent.

21. The project report may be word processed (videos, photographs attached in soft copy) and submitted in triplicate two weeks before the end of VI semester.

22. Involve passionately in the team work, make constructive contributions and come out with an industry friendly project which will equip you in your professional development.
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<td>c) Soldering</td>
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<td>a) Trays</td>
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<td>b) Elbows</td>
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<td>c) Funnel</td>
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<td>d) Mug</td>
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<td></td>
<td>e) Measuring can</td>
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<td>Exercise of Grooving, Folding &amp; punching of sheet metal components.</td>
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<td>Exercise on sheet metal drawing</td>
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**Total** 90
### SCHEME OF EVALUATION

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COURSE : WELDING AND SHEET METAL TECH
CLASS : VTH SEM
SUBJECT : WELDING SHOP - III
SUB CODE : WS

NO. OF HRS/WEEK : 6HRS

PART - A
LIST OF EXPERIMENT
1. Welding in different positions.
2. Edge preparation for different thickness of metals
3. Exercise on CO2 welding, submerged arc welding, Argon arc welding
4. Pipe and flange joints
5. Column splices and Bases
7. Simple exercise on Electrical Storage Base, Fabrication of welding gates, window and grills etc.

PART B
LIST OF EXPERIMENT
8. Destructive testing methods for evaluating the strength of welded joints such as
   8.0 Tensile test
   8.1 Study of universal testing machine
   8.2 Conduct the test to find the tensile strength of welded joints
   8.3 Calculate stress-strain, yield point, maximum strength breaking stress, plateau stress strain curve, to find out percentage of elongation and percentage of decreasing area of cross-section.
9. Hardness Test
   9.1 Study of Brinell hardness testing machine
   9.2 Study of Rockwell testing machine
   9.3 Preparation of specimen's (MS Brass, aluminum etc.)
   9.4 Conduct the test to find out hardness and to calculate the hardness No. (Brinell, Rockwell, hardness)
10. Bend test
    10.1 Conduct the bend test using UTM and calculate using formula
    10.2 Prepare the weld specimen for bend test
11. Impact test
    11.1 Study of impact (charpy - 5)
    11.2 Conduct impact test (charpy - 5) for welded specimens.
12. Shear test
12.1 conduct the shear test (MS Brass, Aluminum etc.) by using UTM.
12.2 Calculate the percentage reduction in length and percentage of area of cross section.

**SCHEME OF EVALUATION**

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COURSE : WELDING AND SHEET METAL TECH
CLASS : VI TH SEM
SUBJECT : ELECTIVE SUBJECT -1
         (NDT of welded joints & Automation in welding)
SUB CODE : WS

NO. OF HRS/WEEK : 4HRS
TOTAL NO. OF HRS : 64 HRS

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GENERAL EDUCATION OBJECTIVES

(1) Know the weld inspection and quality control.
(2) Study the various destructive tests.
(3) Study the different types of non-destructive tests.
(4) Understand pressure liquid testing process.
(5) Understand the non-destructive testing of adhesive joints.
(6) Know the automation in welding.

SPECIFIC INSTRUCTIN OBJECTIVES

1.1 Define weld inspection and quality control.
1.2 Write visual inspection measurement.
1.3 Write the equipment’s require visual inspection.
2.1 Define tensile test, bend test and impact test.
2.2 Explain nick break test and hardness test.

3.1 Define non-destructive test.
3.2 Explain liquid pen entrant testing.
3.3 Write a note on eddy current testing.
3.4 Explain briefly ultra-sonic test.
3.5 Explain monographic test.
3.6 Write a note on acoustic test.
3.7 Write a note on comparison as N.D.T method.

4.1 Define pressure and liquid testing.
4.2 Explain resonance test.
4.3 Explain briefly hydrostatic pressure testing.
4.4 Write a note on pneumatic testing.
4.5 Explain briefly vacuum testing.
4.6 Briefly explain leak testing by radioactive material.

5.1 Briefly explain non-destructive testing of adhesive joint.
5.2 What are the defects in adhesive bonded joints.
5.3 Explain N.D.T method employed.

6.1 Define Automation in welding.
6.2 What are classifications of process in Automation in welding.
6.3 Explain briefly manual welding and automatic and automated welding.
6.4 Differentiate clearly between automatic and automated welding.
6.5 Write a note on remote control welding and robotic welding.
6.6 What are the different types of welding robots.
6.7 State the precautions required in the use of robots.
6.8 Write the application and selecting welding system.

COURSE CONTENT

SECTION - I

1.0 WELD INSPECTION AND QUALITY CONTROL
1.1 Introduction.
1.2 Visual inspection and measurement.
1.3 Equipment for visual inspection.
1.4 Visual inspection.

2.0 DESTRUCTIVE TEST.
2.1 Tensile test, Bend test, impact test.
2.2 Hardness test, nick break test, ethic test.
SECTION - II

3.0 NON-DESTRUCTIVE TEST (NDT)
3.1 Liquid - penetrate testing.
3.2 Magnetic Particle testing.
3.3 Eddy current testing.
3.4 Magneto graphic testing.
3.5 Radio graphic testing.
3.6 Ultrasonlic testing.
3.7 Acoustic emission testing.
3.8 Comparison of NDT methods.

SECTION - III

4.0 PRESSURE AND LEAK TESTING
4.1 Kerosene test.
4.2 Hydra static pressure testing.
4.3 Air pressure or pneumatic testing.
4.4 Vacuum testing.
4.5 Halide test.
4.6 Helium test.
4.7 Leak testing by radioactive material.

5.0 NON-DESTRUCTIVE TESTING OF ADHESIVE JOINTS
5.1 Defects in adhesive bonded joints.
5.2 NDT method employed.

6.0 AUTOMATIC IN WELDING
6.1 Welding sequence and classification of process.
6.3 Automated welding, Adoptive control.
6.4 Automatic welding Verse automated welding.
6.5 Remote control welding, robotic welding.
6.6 Types of welding, robotic welding.
6.7 Precautions in the use of robots.
6.8 Application, Selecting a welding system.

1.0 TEST AND REVISION

REFERENCE BOOKS:
1.
2.
SCHEME OF EXAMINATION
Section I compulsory
1. a) Fill in the blanks-  
   b) 05 marks

Section II, III, IV answer any two full question from each section 90 marks
Total 100 marks

PAPER SETTING
Section I
1. a) Fill in the blanks (from all chapter) 05 marks
   b) 05 marks

Section II Set 3 question each carry 15 marks 45 marks

Section III Set 3 question each carry 15 marks 45 marks
Section IV Set 3 question each carry 15 marks 45 marks
### Generic Educational Objectives

On completion of the course, the students should be able to:

1. Understand the basic concepts of CIM and Automation
2. Know the fundamentals of CAD system
3. Know the concept of NC and CNC
4. Understand the basic structure of CNC machines and its components
5. Understand the programming concepts of CNC machines
6. Know the fundamentals of CAM
7. Understand the concept of Robotics and appreciate its role in Industry
Content details:

1. Introduction of CIM and Automation
   1.1 Product Cycle and CAD/CAM – Basic concepts and definitions
   1.2 CIM – definition, scope and elements of a CIM system
   1.3 Automation – definition and elements of an automated system
   1.4 Types of automation and levels of automation
   1.5 Reasons for Automation (benefits)

2. Fundamental of CAD
   2.1 Product design – steps involved in manual design
   2.2 Application of computers in design
   2.3 Creation of manufacturing database
   2.4 CAD system hardware – design workstation, plotters & printers and storage devices
   2.5 Benefits of CAD

3. Introduction of CNC
   3.1 NC – definition
   3.2 Basic components of an NC system
   3.3 Applications of NC – Machining applications and non-machining applications
   3.3 Motion control systems – PTP and continuous path systems
   3.4 CNC – definition and features
   3.5 Distributed numerical control (DNC)
   3.6 Machining Centers – definition, features and classification

4. Structure of CNC machines
   4.1 Machine structure – static, dynamic and thermal loads
   4.2 Guide ways – different types
   4.3 Drives in CNC – Feed drives, Spindle drives and their requirements
   4.4 Motors – servo motors, servo principle and stepper motors
   4.5 Mechanical transmission system – Ball screws, rack & pinion, gear box, timing belts and Flexible couplings.
   4.6 Spindle bearings – hydrostatic, hydrodynamic and Antifriction bearings
   4.7 Measuring systems – types, Rotary encoder and linear scales
4.8 Controls, software and user interface
4.9 Gauging and tool monitoring
4.10 Compensations for machine accuracy

5 Programming of CNC machines
5.1 Introduction to programming
5.2 Types of dimensioning
5.3 Axis and motion nomenclature
5.5 Structure of part program – word addressed format
5.6 Preparatory and miscellaneous functions
5.7 Subroutines
5.8 Canned cycles
5.9 Simple programs on turning, milling and drilling
   (To be taught in detail in CNC programming Lab)

6 Computer aided manufacturing
6.1 CAM – definition and categories of CAM
6.2 Components of a Manufacturing system
6.2 Group technology – definition, part family, part classification and coding (opitz system)
6.3 Applications and benefits of GT
6.4 Cellular manufacturing – concept and definition, types of machine cells
6.5 Flexible manufacturing system – definition, types, components and Applications
6.6 Computer aided process planning – retrieval type CAPP and Generative CAPP

7 Robotics
7.1 Introduction, definition and importance of robots
7.2 Robot Anatomy – joints and links, physical configuration
7.3 Basic robot motions – degrees of freedom
7.4 End effectors – grippers and tools
7.5 Programming of Robots
7.6 Applications of robots.
Specific instructional objectives

1. Understand the basic concepts of CIM and Automation
   1.1 Explain the steps involved in product cycle
   1.2 Define CAD, CAM and discuss the role of computers in product cycle
   1.3 Define CIM and discuss the scope of CIM with respect to CAD/CAM
   1.4 Explain the elements of a CIM system
   1.5 Define Automation elements of an automated system
   1.6 Explain the types of automation, levels of automation and reasons for automation

2. Know the fundamentals of CAD system
   2.1 Explain the steps involved in manual design process
   2.2 Give the block diagram indicating relation between manual design and CAD
   2.3 Discuss the applications of computers in design
      2.3.1 Geometric modeling
      2.3.2 Engineering analysis
      2.3.3 Design review and Evaluation
      2.3.4 Automated drafting
   2.4 Give the block diagram of common database created for CAD and CAM
   2.5 Discuss the CAD system hardware – design workstation, plotters and printers and storage devices.
   2.6 Discuss the benefits of CAD

3 Know the concept of NC and CNC
   3.1 Define NC and explain the basic components of NC
   3.2 Discuss the applications of NC in two areas i.e., machining and non-machining areas
   3.3 Explain the motion control systems of NC i.e., PTP systems and continuous path control systems
   3.4 Define CNC and give the difference between NC and CNC
   3.5 Explain the features of CNC
   3.6 Discuss the distributed numerical control (DNC) with a block diagram
   3.7 Define machining centers and discuss the features of machining centers
   3.8 Discuss the classification of machining centers.

4. Understand the basic structure of CNC machines and its components
   4.1 List the basic design factors of machine structure
   4.2 Explain static, dynamic and thermal loads on the machine structure
   4.3 Mention the use of guideways in machine tools
   4.4 Explain frictional guideways with stick-slip phenomenon
   4.5 Explain other types of guideways like Flat, dovetail, Vee and cylindrical type
   4.6 Explain hydrostatic and Aerostatic guideways
   4.7 Explain the role of drives in CNC machines
   4.8 Explain the requirements of feed drives and spindle drives in CNC machines
   4.9 Briefly explain the servo motor with its features and discuss servo-principle
4.10 Explain the stepper motors
4.11 Discuss the role of mechanical transmission system in CNC machines
4.12 Explain ball screws, rack & pinion, gear box, timing belts and flexible couplings
4.13 Discuss the importance of spindle bearings
4.14 Briefly explain hydrodynamic, hydrostatic and antifriction bearings
4.15 Discuss the role of measuring system and its types
4.16 Explain the working principle of rotary Encoder and linear scale
4.17 Outline controls, software and user interface
4.18 Explain gauging and types of tool monitoring systems.
4.19 Explain the various compensations for machine accuracy

5. Understand the programming concepts of CNC machines
   5.1 Explain the factors to be considered while writing the part program
   5.2 Discuss the co-ordinate system and methods of dimensioning
   5.3 Explain axes and motion nomenclature
   5.4 Explain structure of part program with block example of word addressed format
   5.5 Discuss commonly used preparatory and miscellaneous functions
   5.6 Discuss the subroutine programming with an example
   5.7 Discuss the concept of canned cycle as applied to turning program
   5.8 Write simple programs for turning, milling and drilling applications

6. Know the fundamentals of CAM
   6.1 Discuss the role of computers in manufacturing
   6.2 Explain the two categories of CAM – manufacturing planning and manufacturing control
   6.3 Explain manufacturing systems and give its components
   6.4 Define Group technology. Explain part family and discuss opitz system of part classification and coding
   6.5 Discuss the applications and benefits of GT
   6.6 Explain cellular manufacturing and its objectives
   6.7 Explain types of machine cells and layouts
      6.7.1 Single machine cell
      6.7.2 Group machine cell with manual handling
      6.7.3 Group machine cell with semi-integrated handling
      6.7.4 Flexible manufacturing cell
   6.8 Define Flexible manufacturing system
   6.9 Explain various components of FMS like workstations, material handling systems (AGV’s, AS/RS and robots), computer control system and human resources
   6.10 Explain different types of FMS
   6.11 Discuss the Applications of FMS
   6.12 Discuss computer aided process planning
   6.13 Explain Retrieval CAPP and Generative CAPP
7. **Understand the concept of Robotics and appreciate its role in Industry**
   7.1 Define Robots and Discuss the importance of robotics in industry
   7.2 Explain Robot Anatomy
       7.2.1 Explain various joints
       7.2.2 Explain different physical configurations
   7.3 Explain the six degrees of freedom of a robot as applied to arm and wrist
   7.4 Explain the End effectors – various types of grippers and tools
   7.5 Explain different methods of programming of Robots
   7.6 Mention the programming languages used in off-line programming
   7.7 Discuss the applications of robots in industry.

---

**Reference Books:**

1. Automation, production systems and Computer integrated manufacturing
   - Mikell P Groover (PHI edition)
2. CAD/ CAM
   - Mikell P Groover and Emory W. Zimmers
3. Mechatronics
   - HMT
4. CAD/CAM
   - P N Rao

************
Instructions: 1. Section I is Compulsory
2. Answer any TWO full questions each of the remaining sections

Section - I

1. a) What are Canned cycles? Explain it as applied to turning application. -- 05
   b) List out the various types of Grippers used as End effectors in Robots. -- 05
   (Questions for this section are to be taken from Part-B and Part-C only)

Section - II

2. a) Define CIM. Explain the various elements of CIM system with a sketch. -- 06
    b) Explain the different types of Automation. -- 05
    c) Mention the steps involved in manual design process with a block diagram. -- 04

3. a) Explain applications of computers in design process -- 08
    b) Mention any seven benefits of CAD -- 07

4. a) Explain the basic components of NC with a diagram. -- 07
    b) What are the features of CNC? -- 04
    c) Explain Distributed numerical control with a diagram -- 04

Section – III

5. a) Explain the different loads to be considered while designing machine structure of a CNC Machine. -- 09
    b) Explain stick-slip phenomenon in frictional guideways. -- 06

6. a) Differentiate between direct and Indirect measuring system. -- 04
    b) Explain any three compensations for machine accuracy. -- 06
    c) Explain hydrodynamic bearing with a neat sketch. -- 05

7. a) Explain Absolute and Incremental mode of dimensioning -- 06
    b) Write a subroutine program for the given sketch. -- 09
Section – IV

8  a) Define CAM. Discuss the two categories of CAM -- 05  
   b) Explain Opitz system of part classification and coding. -- 05  
   c) Explain the various components of FMS -- 05  

9. a) Explain Retrieval type CAPP with a neat sketch -- 09  
    b) Define Robot. Discuss the importance of robots in industry -- 06  

10. a) Explain degrees of freedom of a robot with a neat sketch. -- 09  
       b) Mention any six applications of Robots.
### METAL CASTING SCIENCE AND ENGINEERING

**Subject Title:** METAL CASTING SCIENCE AND ENGINEERING  
**Subject Code:** WS  
**Hours Per Week:** 04  
**Hours Per Semester:** 64

#### TOPIC ANALYSIS

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#### OBJECTIVES

On the completion of the course the students should be able to understand:

1. The importance of metal casting science and engineering
2. The concept of casting processes
3. The importance of design of gating and risering of castings
4. The construction and working of melting furnaces
5. The importance of pouring practice
6. The importance of cleaning and inspection of castings
7. The importance of quality in casting industry
8. The importance of mechanisation and computerisation in foundry
9. The application of CAD/CAM in foundries
10. The importance of casting simulation
11. The importance of pollution control in foundries

#### COURSE CONTENTS
1.0 Introduction to Metal Casting

1.1 Introduction
1.2 Casting - As basic manufacturing process, Importance and Applications
1.3 New casting development
1.4 Casting Processes
   1.4.1 Hierarchical classification of various casting processes
   1.4.2 Continuous Casting, Squeeze Casting and Semi-solid casting process
   1.4.3 Advantages, disadvantage and applications of above mentioned casting processes.

2.0 Gating and Risering

2.1 Introduction
2.2 Elements of Gating system
2.3 Design of Gating system
   2.3.1 Objectives achieved from good gating design
   2.3.2 Turbulence in gating system
   2.3.3 Metal flow rate and velocity calculations
   2.3.4 Design criteria for pouring basin and sprue
   2.3.5 Pouring time
   2.3.6 Design of Runner and Ingate
   2.3.7 Practical rules for Gating practice
2.4 Risering of Castings
2.5 Risering practice for alloys
2.6 Solidification of castings
   2.6.1 Concept of solidification of pure metals and binary alloys
   2.6.2 Solidification rate, Solidification time and Chvorinov’s rule
2.7 Progressive solidification, Directional solidification and control of solidification to obtain sound castings

3.0 Melting and Pouring Practice

3.1 Introduction
3.2 Choice or selection of Melting furnace
3.3 Melting furnaces for foundries
   3.3.1 Cupola
   3.3.2 Crucible
   3.3.3 Electric Arc furnace
3.4 Pouring of molten metal and handling tools

4.0 Cleaning and Inspection of Castings
4.1 Introduction
4.2 Methods of cleaning - Fettling, Tumbling, Pickling, Sand and Shot blasting
4.3 Dressing of Castings
4.4 Importance of inspection
4.5 Non-destructive methods of Inspection - Visual inspection, Sound test, Pressure test, Radiographic (X-ray) test, Magnetic particle test, Fluorescent penetrate inspection, and Ultrasonic inspection
4.6 Recent Developments in Inspection and Testing - Thermal Inspection, X-Ray Diffraction Analysis, Image Analysis and Computerized Testing

5.0 Casting Defects and Quality Control in Foundries

5.1 Introduction
5.2 Defects in casting - Causes and Remedies,
5.3 Salvage of Defective Castings
  5.3.1 Factors affecting salvage of castings
  5.3.2 Salvaging techniques
  5.3.3 Repair of Gray Iron, S.G. Iron, Steel, Aluminum alloy and Copper alloy castings
5.4 Quality control in foundries
5.5 Statistical methods in quality control of castings - Sampling inspection and Control Charts
5.6 Statistical process control (SPC) in foundries

6.0 Mechanisation, Computerisation and Pollution Control of Foundries

6.1 Introduction
6.2 Need for Mechanization
6.3 Areas of Mechanization
6.4 Application of Computer and Robots in foundries
6.5 Energy Saving in Foundries
6.6 Pollution Control in Foundries
  6.6.1 Importance of Pollution Control in foundries
  6.6.2 Pollutants produced in different sections of foundry
  6.6.3 Methods to control pollutants produced in a foundry
  6.6.4 Environment standards and certification

7.0 Application of CAD/CAM in Foundries

7.1 Introduction
7.2 Solid modelling techniques
7.3 Model representation and exchange formats
7.4 Computer-aided design of patterns and dies
7.5 Computer-aided manufacture of tooling
7.6 Computer-aided inspection of tooling

8.0 Casting Simulation and Optimization
SPECIFIC INSTRUCTIONAL OBJECTIVES

1. Introduction to Metal Casting
   1.1 Appreciate the importance of metal casting in engineering
   1.2 State some of major application areas of metal casting in engineering
   1.3 List major metals in use today (by weight) along with their main characteristics and typical applications
   1.4 Explain the major stages in developing a new casting in a foundry
   1.5 Appreciate the special casting processes
   1.6 Explain the Hierarchical classification of various casting processes with the help of flow diagram
   1.7 Explain Continuous casting, Squeeze casting and Semi-solid casting process
   1.8 State the advantages, disadvantages and application of above mentioned casting processes

2. Gating and Risering
   2.1 Explain the principles of Gating
   2.2 Explain the Requirements, purpose/functions of the gating system
   2.3 Explain with line diagram Pouring Cups and Basins, Sprues and Gates
   2.4 Explain the importance of Design of gating system (objectives achieved from good design)
   2.5 Explain the effect of Turbulence in gating system
   2.6 Explain how to calculate Metal flow rate, velocity and Pouring time (simple problems)
   2.7 Explain Design criteria for pouring basin
   2.8 Explain Design of sprue, runner and ingates
   2.9 State the Practical rules for good gating practice
   2.10 Explain how slag and dross are eliminated in case ferrous and non-ferrous alloys
       (Iron, Copper, Aluminium and Magnesium alloys)
   2.11 Explain the Principles of Risering
   2.12 Explain the difference between open and blind riser
   2.13 Explain how the location of Riser affects the Directional Solidification
   2.14 Explain how to increase riser efficiency by Promoting Directional Solidification
2.15 State the aims and general principles of Riser system design
2.16 Explain the importance of riser location and feeding distance for riser system design
2.17 Explain the Concept of solidification of pure metals and binary alloys
2.18 Explain Solidification rate, Solidification time and Chvorinov’s Rule
2.19 Explain how to obtain sound castings by controlling Progressive and Directional Solidification

3. Melting and Pouring Practice

3.1 Understand the melting furnaces and their operations
3.2 Choice or Selection of furnace for melting different metals and alloys
3.3 Explain the construction and operational details of Cupola, Crucible furnace (pit and tilting type) Electric furnace (direct and indirect electric arc furnace)
3.4 State the advantages and disadvantages of above mentioned furnaces
3.5 Explain Cupola charge calculations (simple problems)
3.6 Explain Recent Trends in Cupola melting
3.7 Melt pouring
3.8 Explain different Pouring Equipments used in foundry
3.9 Explain Pouring Practice (including automatic pouring)

4. Cleaning and Inspection of Castings

4.1 Know the different methods of cleaning and inspection of casting.
4.2 Explain the necessity for cleaning of casting.
4.3 Explain different methods of cleaning
4.4 Explain the need for inspection of casting
4.5 Explain the principle and operation of visual inspection, pressure test, radiographic test, sound test, magnetic particle test, fluorescent penetrate test and ultrasonic inspection.
4.6 Explain Recent Developments in Inspection and Testing of castings

5. Casting Defects and Quality Control in Foundries

5.1 Identify the different types of casting defects
5.2 State the causes for casting defects and suggest the remedies
5.3 Explain the different techniques for repair of ferrous and non-ferrous casting
5.4 Explain how casting quality can be controlled in different stages of casting process
5.5 Explain how statistical methods can be used in quality control of castings
5.6 Explain how process variations can be controlled through the use of SPC

6. Mechanisation, Computerisation and Pollution Control of Foundries

6.1 Appreciate the importance of Mechanization of foundries
6.2 List the areas for Mechanization
6.3 Explain the need for Mechanization
6.4 Identify the areas where Computers and Robots can be used in foundry
6.5 Explain the areas where energy conservation programmes can be effectively introduced in
a foundry.

7. **Application of CAD/CAM in Foundries**

7.1 Explain casting features related to product and tooling
7.2 Explain different modelling techniques commonly used in foundries
7.3 State the advantages and limitations of solid modelling systems
7.4 Explain how CAD/CAM helps in improving foundry operations

8. **Casting Simulation and Optimization**

8.1 Explain how simulation helps in casting quality and yield improvement
8.2 Explain the different software programs used for casting methoding and simulation
8.3 Briefly describe and compare the features of various foundry software
8.4 Explain the major inputs and outputs of various simulation software
8.5 Explain the usefulness of internet communication in casting supply chain

**REFERENCES:**

4. Foundry technology – Sinha and Goel
5. Foundry technology – R.B.Gupta
DERARTMENT OF TECHNICAL EDUCATION
DIPLOMA COURSE IN MECHANICAL ENGINEERING
SIXTH SEMESTER
MODEL QUESTION PAPER
METAL CASTING SCIENCE AND ENGINEERING

Time: 3Hrs
Max marks: 100

Note: 1. Section-1 is compulsory
2. Answer any two full questions from each of the remaining sections

Section-1

1. (A) Fill in the blanks with appropriate words:
   (i) The casting is one of the basic ____________ process.
   (ii) Reducing variability and defects is the essence of ____________ concept.
   (iii) The ultrasonic waves are usually generated by ____________ effect.
   (iv) The crucibles used in foundries are made of clay and ____________ materials.
   (v) The risers promote ____________ solidification
   (B) Write an explanatory note on Internet Based Foundry Engineering

Section-2

2. a) Give the flow diagram showing the hierarchical classification of various casting processes.
   b) List the factors to be considered in the selection of suitable furnace for melting a metal in foundry.

3. a) Design the gating and risering system for rectangular plate steel casting with dimensions of 1000 mm x 1000 mm x 100 mm.
   b) Explain the use of chills in achieving directional solidification.

4. a) Define Gating ratio.
   b) Differentiate between function of top riser and blind riser.
   c) Explain in brief the different techniques available for improving casting yield.

Section-3

5. a) With a neat sketch describe the working of pit type crucible furnace.
   b) A cupola of 75 cm diameter has melting ratio of 10:1, calculate
      (i) the air required for complete combustion
      (ii) air required to melt 500 kg of iron at this ratio
      (iii) the coke required to melt 500 kg of iron if melting ratio is 8:1
      (iv) the air required to melt 500 kg of iron if melting ratio is 8:1.
      Assume the weight of regular charge of coke as 32 kg
      (v) State the advantages and disadvantages of direct electric arc furnace.

6. a) Explain briefly Quality control as applied to foundries.
   b) Explain sampling inspection.
   c) Explain the ultrasonic method of casting inspection.

7. a) Mention the differences between a base feature and a local feature in a casting model.
b) List various tooling features in a sand casting and die casting that need to be solid modelled.  
5

c) Give the relative merits and demerits of solid modeling based on conventional, haptic and virtual reality user interface.  
5

Section- 4

8. a) Draw a detailed layout of cast iron foundry and indicate the possible areas where computers can be used.  
9

b) List the major pollutants emitted/produced in a foundry.  
6

9. a) State the functions of various elements that comprise of gating system.  
5

b) Briefly explain control charts for variables as used in foundries.  
5

c) Explain Chvorinov's rule.  
5

10. Write short notes on any three of the following : 5X3=15  

   a) Directional Solidification    
   b) Energy saving techniques in foundries
   c) Exothermic sleeves          
   d) Applications of robots in foundries.
List of experiment

1. Study of equipment’s and process in Electroplating shop
2. Determine the effects of different acids like hydrochloric acids, sup uric acid and Nitric acid on different metals
3. Practice of dressing energy wheels
4. Practice the process of polishing and biffing of different metals
5. Practice of chemical cleaning on mold steel and other metals
6. Demonstration of process used for sample preparation for plating such as Grinding sand, Blasting barred finishing scratch brushing
7. Preparing various electrolytes for electroplating of copper, Nickel and Chromium Testing the solution on different metals. Determination of PH value for the above solutions
8. Preparing the various metals for electroplating such as
   a) Copper plating on mild steel
   b) Nickel plating on copper plating on brass
   c) Nickel and Chrome plating on brass
   d) Nickel and chrome plating on copper

9. Anodizing on a given Aluminum articles
10. Coloring on anodized Aluminum articles
11. Practice of Etching on Aluminum and brass
### SCHEME OF EVALUATION

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COURSE : WELDING AND SHEET METAL TECH
CLASS : VI TH SEM
SUBJECT : METAL FINISHING
SUB CODE : WS

NO. OF HRS/WEEK : 4HRS
TOTAL NO. OF HRS :64 HRS

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GENERAL EDUCATION OBJECTIVES:-

(1) Under the principle, object and applications and electroplating.
(2) Know the technical terms in electroplating.
(3) Study the concept and corrosion and its prevention.
(4) understand the law of faraday's and its applications.
(5) Know the cleaning and metals before electroplating.
(6) Study the materials used in electroplating.
(7) Know the layout of electroplating shop and safety precautions.
(8) Study the use and electroplating vats.
(9) Understand the use of electrical equipment’s in electroplating shop and electroplating solutions.
(10) Study the different types of electroplating process.
(11) Know the anodizing lacquering and etching.

SPECIFIC INDUSTRIAL OBJECTIVES:-

1.0 Define electroplating.
1.1 Mention the applications of electroplating.

2.0 Illustrate the process of electroplating.
2.1 Mention the different electrolytes and non-electrolytes.
2.2 Explain conductors, insulators. Anode, cathode, ions, electrons.

3.0 Define corrosion and mention its effects on metals.
3.1 Mention the methods to prevent corrosion.
3.2 Define painting, galvanizing and enameling.

4.0 State the faraday's laws of electrolysis.
4.1 Determine the ECE and Cu.

5.0 State the principle of metal cleaning.
5.1 Mention different mechanical cleaning process.
5.2 Explain different polishing methods.
5.3 Explain polishing lathe with a neat sketch.
5.4 Mention different dressing mops and polishing mops.
5.5 State the special methods of cleaning.

6.0 Describe acids base and alkaline.
6.1 State the properties of acids and bases.
6.2 Explain hydrolysis,
6.3 Mention the properties and uses of sulfuric acid, nitric acid and hydrochloric acid.

7.0 State the principle of layout and electroplating shop.
7.1 Explain manually operated electroplating shop.
7.2 Describe the automatic plant layout.
7.3 Mention the safety precautions in plating shop.

8.0 Explain the use of vats in electroplating shop.
8.1 Explain with neat sketch the electroplating vat.

9.0 MENTION ELECTRIC POWER REQUIRED FOR PLATING.
9.1 Sketch and explain plating generator and rectifier with their connections.
   1
10.0 Mention the properties of plating solutions.
10.1 Determine the density of a solution.
10.2 Explain PH value of plating solutions.
11.0 Explain electroplating process like nickel plating, chromium plating, copper plating, cobalt plating, zinc plating etc.

12.0 Explain anodizing.

13.0 Explain lacquering

COURSE CONTENTS
SECTION - I
1.0 OBJECT AND APPLICATION OF ELECTRODE POSITION
   1.1 Definition of electroplating
   1.2 Different application of electrode position protective coating purpose built up purpose refining purpose refining extraction purpose

2.0 TECHNICAL TERMS IN ELECTROPLATING
   2.1 Illustrate the process of electrolysis
   2.2 Different electrolytes and non-electrolytes
   2.3 Describe electrodes conductors insulators, anode, cathode, ions electrons

3.0 CORROSION OF METALS
   3.1 Definition of corrosion and its effects on metals
   3.2 Methods to prevent corrosion
   3.3 Definition of painting galvanizing timing enameling

4.0 LAWS OF FARADAY’s
   4.1 Statement of faraday’s laws of electrolysis
   4.2 Determination of ECE
   4.3 Problems based on faradays law

5.0 CLEANING OF METALS
   5.1 Principle of metals cleaning
   5.2 Different mechanical cleaning process- sand and shot blasting grinding polishing and buffing barrel cleaning
   5.3 Polishing lathe sketch belt drive and self-motor drive
   5.4 Spindle attachment of polishing lathes
   5.5 Polishing equipment for manual polishing automatic polishing machines
   5.6 Polishing method –abrasive finish polishing and buffing abrasives abrasive dressed wheels with figure
   5.7 Dressing mops-different types of mops-polishing compositions
   5.8 Polishing mops- different types of mops –polishing compositions
   5.9 Barrel cleaning- types of barrels barrel media
5.10 Chemical cleaning and its method - Preliminary cleaning or degreasing picking and dripping
5.11 Special method of cleaning - ultrasonic cleaning, electrolytic cleaning, electro polishing and barrel cleaning
5.12 Scoring and dinning

SECTION-II

6.0 MATERIALS USED IN ELECTROPLATING SHOP
6.1 Describe acid based, salts and alkalinate
6.2 General properties if acids, classification of acids strength of acids, equipment’s weight of acids
6.3 Properties and use of sulfuric acids, nitric acids and hydrochloric acid
6.4 General properties of based, acidity of based and neutralization
6.5 Classification of salts-hydrolysis
6.6 Other materials used like cyanide luster bar peerless polish

7.0 LAYOUT OF ELECTROPLATING SHOP AND SAFETY PRECAUTIONS
7.1 General principle of layout of electroplating shop
7.2 Manual operate electroplating shop-sketch and explanation
7.3 Automatic plant layout
7.4 Safety precaution in plating shop

8.0 ELECTROPLATING VATS
8.1 Use of vats in electroplating shop
8.2 Electroplating vat-sketch and explanation
8.3 Vat and Vat lining for different process chart

9.0 ELECTRICAL EQUIPMENT
9.1 Electro power required for plating
9.2 Sketch and explain plating generator and rectifier with their connection
9.3 Anodes, anodes hooks, cathode hooks, jigs and fixtures care of anodes

10.0 ELECTRICAL EQUIPMENT
10.1 Properties of plating solutions
10.2 Ingredients and its function in plating solution
10.3 Density of solution
10.4 Determining of density
10.5 PH value of plating solution, agitation of plating solution filtration of plating solution
SECTION-III
11.0 ELECTROPLATING PROCESS
   11.1 Nickel plating process chemical composition of bright dull and black nickel plating solution, stripping of nickel deposition in nickel plating their causes and remedies
   11.2 Chromium plating process-necessity of coating nickel prior to chromium plating preparation of chromium deposition defects causes and remedies in chromium plating
   11.3 Copper plating process cyanide and remedies
   11.4 Cadmium plating process—Chemical composition-operating condition
   11.5 Cobalt plating process—chemical composition-operating condition
   11.6 Brass plating process
   11.7 Zinc Plating process—Chemical composition operation condition
   11.8 Silver plating process—chemical composition operation condition, contorting of silver plating
   11.9 Gold plating process—plating process—chemical composition operation condition
   11.10 Barrel plating process

12.0 ANODIZING
   12.1 Sulfuric acid and chromic acids anodizing coloring of anodized aluminum

13.0 LACCUERING AND FOR VREFERENCES

REFERENCE BOOKS
1. Principle of electroplating—WILLIAM BLUM
2. Canning electroplating handbook-CANNING
SCHEME OF EXAMINATION
Section I compulsory
1. a) Fill in the blanks- 05 marks
   b) 05 marks

Section II, III, IV answer any two full question from each section 90 marks
Total 100 marks

PAPER SETTING
Section I
1. a) Fill in the blanks (from all chapter) 05 marks
   b) 05 marks

Section II Set 3 question each carry 15 marks 45 marks

Section III Set 3 question each carry 15 marks 45 marks
Section IV Set 3 question each carry 15 marks 45 marks
COURSE: WELDING AND SHEET METAL TECH
CLASS: VI TH SEM
SUBJECT: METALLURGY OF WELDED JOINTS
SUB CODE: WS

NO. OF HRS/WEEK: 4HRS
TOTAL NO. OF HRS: 64 HRS

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General Education Objectives:
(1) Review the Arc Welding and Gas Welding process
(2) Understand the structure of metals
(3) Study the physical and mechanical properties of metals and alloys
(4) Know the concept of heat transfer
(5) Understand the weld ability of metals
(6) Study the Metallurgical effects of welding
(7) Understand the concept of distortion and methods of measuring residual Stresses
(8) Know the different defects in welding
(9) Know the repairs of riveted structures, costing and forging
(10) Understand the heat treatment in welding

Specific Instructional Objectives:-

1.0 MENTION THE ARC AND GAS WELDING PROCESSES

2.0 EXPLAIN THE ELEMENTS CLASSIFICATION BY ELECTROLYSIS
   2.1 Explain atomic structure space lattice miller inside.
   2.2 Describes Iron – Iron carbide equilibrium.
   2.3 Explain cooling curve and heat evolution

3.0 EXPLAIN THE MECHANICA PROPERTIES OF METALS AND ALLOYS
   3.1 Explain volatility, electricity conductivity, thermal conductivity and magnetism.
   3.2 Define resilience, fatigue failure and weld ability.

4.0 DEFINE THERMAL CONDUCTION, CONVECTION AND RADIATION
   4.1 Explain conduction through thick plane wall.
   4.2 State concept of block, white and opaque bodies.
   4.3 Define Stefan-Boltz law.
   4.4 Explain Absorption and Transmission.
   4.5 Explain Natural and forced convention.

5.0 DEFINE WELD ABILITY
   5.1 Mention the weld ability tests.
   5.2 Explain weld ability of mild steel, cost iron, aluminum and stainless steel.

6.0 EXPLAIN HEAT FLOW IN AND AROUND METALS
   6.1 Mention the metallurgical effects of welding.
   6.2 Explain adsorption of gases by welds.
   6.3 Describe iron – carbon equilibrium diagram.
   6.4 Explain porosity in welds.

7.0 EXPLAIN CONCEPT OF DISTORTION
   7.1 Mention the types of welding distortion.
   7.2 Explain the methods of measuring residual stresses.

8.0 EXPLAIN THE FOLLOW DEFECTS
   (i) Cracks (ii) Inclusion (iii) Porosity (iv) Undercutting (v) Burn through (vi) Tungsten inclusion.

9.0 EXPLAIN THE REPAIR OF COSTING AND RIVETING
   9.1 Explain the repair of Riveted Structure.

10.0 WHAT THE PURPOSE OF HEAT TREATMET
    10.1 Explain Carbonizing, Flame Hardening, Siliconizing.
COURSE CONTENTS

1.0 WELDING PROCESS
1.1 Bring review of Arc welding process.
1.2 Bring review of gas welding process.

2.0 STRUCTURE OF METALS
2.1 Elements classification by electrolysis.
2.2 Atomic Structure.
2.3 Atomic bonds and space lattice.
2.4 Miller indices and dendrites.
2.5 Cooling curves and heat evolution.
2.6 Volumetric shrinkage.
2.7 Eutectic equilibrium diagram derivation.
2.8 Iron-iron carbide equilibrium diagrams derivation.
2.9 Identifying of Metals by spark test.

3.0 PHYSICAL AND MECHANICAL PROPERTIES OF METALS AND ALLOYS
3.1 Strength.
3.2 Elasticity.
3.3 Toughness.
3.4 Ductility.
3.5 Malleability.
3.6 Weldability.
3.7 Resistance to heat and arresting.
3.8 Fatigue failure.
3.9 Resilience.
3.10 Harness.
3.11 Volatility.
3.12 Electrical conductivity.
3.13 Thermal conductivity.
3.14 Magnetism.

4.0 HEAT TRANSFER
4.1 Thermal conduction.
4.2 Basic equations.
4.3 Conduction through thick plain wall.
4.4 Composite wall and pipe logging.
4.5 Thermal convention.

10.2 Explain quenching, Austempering.
SECTION - II

5.0 WELDABILITY OF METALS
5.1 Definition of Weldability.
5.2 Weldability tests - theoretical tests.
5.3 Stimulated tests.
5.4 Visual examination for weldability.
5.5 Component sampling test.
5.6 Actual welding test.
5.7 Service weldability test - tensile test.
5.8 Bend test.
5.9 Impact test.
5.10 Hardness test.
5.11 Weldability of mild steel, low alloy steel.
5.12 Weldability of cast iron.
5.13 Weldability of aluminum.
5.14 Weldability of stainless steel.

6.0 METALLURGY OF WELDING
6.1 Introduction.
6.2 Heat flow in and around metals.
6.3 Metallurgical effects of welding.
6.4 Weld metals solidification.
6.5 Absorption of gases by welds.
6.6 Gas - metal reactions.
6.7 Porosity in welds.
6.8 Iron-carbon equilibrium diagram and time temperature - Transformation diagram.
6.9 Thermal effects of welding on parent metals and its mechanical properties.
6.10 Grain size control.

SECTION - III

7.0 WELDING STRUCTURES AND DISTORTION
7.1 Distortion and residual stresses.
7.2 Concept of distortion.
7.3 Types of distortion.
7.4 Control of welding distortion.
7.5 Methods of measuring residual stresses.

8.0 WELDING DEFECTS
8.1 Cracks in welds - hot crack, cold crack, hydrogen induced cracks chevron cracks, lamella cracks and re-heat cracks.
8.2 Distortion in complete penetration.
8.3 Inclusion, porosity poor fusion.
8.4 Under cutting, over lapping, spatter.
8.5 Burn through tungsten inclusions.

9.0 REPAIR AND MAINTENANCE WELDING
9.1 Repair of casting and forging.
9.2 Repair of riveted structures.

10.0 HEAT TREATMENT
10.1 Surface hardening.
10.2 Carburizing, nit riding cyaniding.
10.3 Chromizing, Siliconizing.
10.4 Flame hardening.
10.5 Induction hardening.
10.6 Quenching annealing.
10.7 Austempering.

REFERENCE BOOKS:
1.
2.

SCHEME OF EXAMINATION
Section I compulsory
1. a) Fill in the blanks- 05 marks
   b) 05 marks

Section II, III, IV answer any two full question from each section 90 marks

Total 100 marks

PAPER SETTING
Section I
1. a) Fill in the blanks (from all chapter) 05 marks
   b) 05 marks

Section II Set 3 question each carry 15 marks 45 marks

Section III Set 3 question each carry 15 marks 45 marks
Section IV Set 3 question each carry 15 marks 45 marks
Course: Welding and Sheet Metal Technology  
Class    : VIth  Sem  
Subject:  Press Tool Technology  
Sub Code:  WS  

No. Of Hrs/Week : 4hrs  
Total No. Of Hrs : 64 Hrs

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**General Educational Objectives:-**  
Upon the completion of the subject the student should be able to:

1. Appreciate the importance of the subject.  
2. Understand the principle and presses and types of presses.  
3. Study the special type of presses.  
4. Know the principle and types of Drawing operations.  
5. Study the different method of constructing the dies.  
6. Know the methods of fastening punch and die.  
7. Study the die detail functions and its nomenclatures.  
8. Understand the design techniques of punch and die.
(9) Understand the strip layout techniques.
(10) Study the importance of clearance in press tool.
(11) Know the tonnage calculations of shearing, drawing and bending operations.
(12) Estimate the blank size for different shape of sheet metal drawing.
(13) Know the precautions to be taken on presswork and method of automating presses.
(14) Understand the die setting on single action and double active press.
(15) Know the factors to be considered for die material section, punch material selection.
(16) Study the heat treatment for punch and die tools.

Specific Instructional Objectives:-
1.0 Know the principle of presses.
1.1 Mention the different types of presses.

2.0 Explain double action and triple action presses.
2.1 Describe hydraulic, toggle, coining, notching presses.
2.2 Explain bending press, press break, transfer press.

3.0 State the principle of drawing operation.
3.1 Explain shallow, deep and redrawing operation.
3.2 Explain rectangular drawing.

4.0 Explain push-through cutting die and punch through blanking die.
4.1 Describe combination and continental die.
4.2 Explain progressive die and transfer die.
4.3 Mention the functions of follow die and shuttle die.

5.0 Explain the standard methods of fastening punch and die.

6.0 Mention the functions of punch shoe and die shoe
6.1 Explain stripper plate, die spring, blanking plate and knock out pin.
6.2 State the functions of chute, pilot, crew, dowel and pressure pin.
6.3 Mention the functions of die cushions.

7.0 Mention the factors to be considered while designing.
7.1 Explain the designing of punch, die, stripper plate, guide pins and bushes, die block.

8.0 State the purpose of layout.
8.1 Mention the methods of layout
8.2 Important in die designing.

9.0 Importance of a clearance in press tool.
9.1 Mention the effects of excessive and less clearance.
9.2 Explain punch clearance, die clearance and angular clearance.
9.3 Explain "Angle of shoe".
10.0 Explain tonnage calculations for shearing, drawing and bending operations.

11.0 Estimate the blank size for different shapes and sheet drawing.

12.0 Mention the precautions to be taken on press work.
12.1 Explain the methods of automation of presses.
12.2 Explain dial feed, hitch feed, magazine feed and conveyors.

13.0 Explain the methods of setting die on single action and double action presses.

14.0 State the factors to be considered for the die selection.
14.1 Selection of die material for die.
14.2 Selection of material for punch, guide pin, punch shoe, stripper plate, backing plate.

15.0 Explain heat treatment of punch and die.
15.1 Explain heat of guide pin and bushes.
15.2 Explain muffle furnace, oil fired furnace, gas fired furnace.

COURSE CONTENT
SECTION - 1

1.0 PRESSES
1.1 Principle of presses.
1.2 Hand operated presses.
1.3 Power operated eccentric crank, knuckle toggle presses.

2.0 SPECIAL TYPE OF PRESSES
2.1 Power operated double action presses.
2.2 Power operated triple action presses.
2.3 Hydraulic presses, double and triple action.
2.4 Toggle press, coining press.
2.5 Friction screw press
2.6 Punching press, multiple punching presses.
2.7 Nibbling and notching press
2.8 Stretcher press rubber press
2.9 Bending press and press break.
2.10 Transfer press and automatic press.
2.11 Forming press.

3.0 DRAWING OPERATION
3.1 Principle of drawing.
3.2 Shallow drawing deep drawing re-drawing.
3.3 Rectangular drawing
4.0 METHODS OF CONTRUCTING DIES
4.1 Push thru cutting and push three blanking die.
4.2 Push thru trimming die.
4.3 Return type-blanking die
4.4 Compound blank and punch and compound blank and draw die.
4.5 Combination and continental die.
4.6 Progressive and transfer die
4.7 Follow and shuttle die.

SECTION - II

5.0 TYPE OF PUNCH AND DIE SUPPORT
5.1 Any six standard method of fastening punch.
5.2 Four methods of die fasteners.

6.0 DIE DETAIL FUNCTIONS AND NOMENCLATURES
6.1.1 Punch show and die shoe.
6.1.2 Die steel and punch steel
6.1.3 Stripper plate, keepers, stripper bout, die spring
6.1.4 Backing plate, knockout plate, knockout pin and knockout pin guide.
6.1.5 Stop block, screw, dowel, key, heal, pressure pin.
6.1.6 Chute, pilot, gage, insert, pad types of gages.
6.1.7 Can and can drivers, hingers and rockers.
6.1.8 Die cushions.

7.0 DIE DESIGN TECHNIQUES
7.1 Factors to be considered while designing
7.2 Frictions of die maker and die designer.
7.3 Designing of punch
7.4 Designing of die
7.5 Designing of stripper plate.
7.6 Designing of guide pins and bushes
7.7 Designing of die block.

8.0 STRIP LAYOUT TECHNIQUE
8.1 Purpose of layout.
8.2 Methods of layout
8.3 Six methods for economic layout
8.4 Importance in die designing

9.0 CLEARANCE IN PRESS TOOL
9.1 Importance of clearance in press tool.
9.2 Effects of excessive and less clearance
9.3 Punch clearance and die clearance
9.4 Angular clearance
9.5 Angle of shear
9.6 Clearance in cutting tool and drawing tool.

SECTION - III

10.0 COMPUTING TONNAGE
10.1 Tonnage for shearing operations
10.2 Tonnage for drawing operations
10.3 Tonnage for bending and forming operations

11.0 DETERMINING BLANK SIZE FOR DRAWING OPERATION
11.12 Estimating blank size for different shape of sheet drawing

12.0 PRESS SAFETY AND AUTOMISATION OF PRESSES
12.1 Precaution to be taken on presswork
12.2 Method of automating presses
12.3 Roll feed, single and double roll feed.
12.4 Dial feed system
12.5 Hitch feed reels cradles
12.6 Conveyors mechanical handle
12.7 Magazine feed

13.0 DIE SETTING
13.1 Die setting on single section presses and hand presses.
13.2 Die setting on double section presses.

14.0 SELECTION DIE STELL
14.1 Factors to be considered for die selection
14.2 Selection of die material for die
14.3 Selection of material for punch
14.4 Selection of material for guide pin
14.5 Die material for punch shoe and die shoe.
14.6 Die material for backing plate and stripper plate

15.0 HEAT TREATMENT OF PRESS TOOLS
15.1 Heat treatment of punch and die
15.2 Heat treatment of guide pin and bushes
15.3 Heat treatment furnaces muffle furnace, oil fired and gas fired air Circulated furnace.

16.0 TEST AND REVISIONS

REFERENCE BOOKS
5. Press tool practice Pt - I to IV - D Haughton Champion & Hall
6. Techniques of press working of sheet metal - D F Eary and E A Roed

SCHEME OF EXAMINATION
Section I  compulsory
1. a) Fill in the blanks-                                  05 marks
       b)                                                                                                      05 marks

Section II, III, IV answer any two full question from each section 90marks
                               Total 100marks

PAPER SETTING
Section I
1. a) Fill in the blanks (from all chapter)                      05 marks
       b)                                                                                                      05 marks

Section II   Set 3 question each carry 15 marks 45 marks
Section III  Set 3 question each carry 15 marks 45 marks
Section IV   Set 3 question each carry 15 marks 45 marks
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Contact Hrs/Week: 6 Hrs.  

As far as possible students should be given application oriented project problems with a view to:

1. Develop an understanding regarding the size and scale of operations and nature of field work in which students are going to play their role after completing the course of study in Mechanical Engineering.

2. Develop an understanding of subject based knowledge given in the classroom in the context of its application at work places.

3. Provide first hand experience to develop confidence amongst the students to enable them to use and apply acquired technical knowledge and skills to solve practical problems of the world of work.

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

5. Practical exposure to an industrial activity

For the fulfillment of above competencies, polytechnics may establish close linkage with 8-10 relevant organizations for providing such an experience. It is necessary that each organization is visited well in advance by respective teachers and activities to be performed by students are well defined. The chosen activities should be such which are of curricular interest to students and of professional value to industrial/field organizations.

**Each Project batch must have Minimum of 5 and maximum of 7 students.**

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

a) Punctuality and regularity (*Log book - mandatory and to be produced during IA verification*)

b) Initiative in learning/Demonstration and fabrication of model

c) Level/proficiency of practical skills acquired

d) Originality

e) Scope for patentability

f) Sense of responsibility

g) Self-expression/Communication skills

h) Interpersonal skills.

g) Report writing skills

h) Viva voce

Some of suggested projects are given below: These are only guidelines, teacher may take any project related to Mechanical and allied area depending upon the availability of projects. Preference should be given to practical oriented projects.

1) **Industrial Visit**

Students are required to undergo an industrial visit for period of at least 3(Three) working days, either in V/VI semester. After completion of their visit the reports should be prepared. Each Student should write the report independently in view of his own observation in industry. All days for the visit should be accounted for clearly giving attendance particulars. The concern accompanying staff is to check student presence and access progress periodically

1.1 **Industrial report**

Students are required to submit a comprehensive report on factory visit with details of the organization where the training was undergone. The comprehensive report should focus on study of plant/ product /process/ along with intensive in-depth study on anyone of the topics such as processes, methods, tooling, plant layout and equipment, highlighting aspects of quality, productivity of the system. Any data, drawings etc should be incorporated with the consent of the Organization. The comprehensive report should be submitted for the end exam for evaluation.

2) **Project work**

_According to the local needs, the following major projects are suggested:_
1. Non-conventional energy
   - Low Cost Solar Water Heating System for Domestic Purpose
   - Fabrication of Solar cooker
   - Study of Community Biogas Plant
   - Fabricate a thermally efficient wood burning stove
   - Solar lamps
   - Solar powered refrigerator

2. Mechatronics/Material handling area
   - Motorized object lifting jack
   - Key controlled- fork lifter
   - Object counting machine
   - Stepper motor control with selected steps for conveyor belts
   - Robotic arm with gripper
   - Material handling device in X,Y,Z motion control
   - Robotic crane
   - Robotic trolley for material handling

3. Fluid power and control area
   - Pneumatic/Hydraulic jack
   - Pneumatic/hydraulic crane
   - Pneumatic/hydraulic Presses
   - Air compressed spray gun
   - Pneumatic transport system

4. Automobile related area
   - Regenerative braking system
   - Steering controlled headlight
   - Engine/motor vibration checker
   - Seat belt automatic locking system
   - Hydraulic braking
   - Electromagnetic shock absorber
   - Digital auto speed limiter

5. Motorized wheel chair
6. Fabrication of various types of lathe attachments
7. Repair and overhauling of various machine tools and lab equipments available at polytechnic
8. Critical Study of existing quality systems and inventory control at industry
9. Mechanical industry fabrication related projects
10. Automatic mopping machine to clean the floor area
11. Automatic milling machine with digital control
12. PCB fabrication
13. Any study project related to Mechanical and allied areas in industry
14. Any project related to industry based problems
15. Any projects related low cost automation

The Project Report should consist of following items.

1. Introduction
2. Review of Literature
3. Study Area
4. Methodology/Design/fabrication/Tests
5. Result and Discussion
6. Conclusion and scope for future study
7. References.

GUIDELINES FOR THE PREPARATION OF PROJECT REPORTS

1. Project reports should be typed neatly in Times New Roman letters with font size 14 for titles and 12 for text on both sides of the paper with 1.5 line spacing on a A4 size paper (210 x 297 mm). The margins should be: Left - 1.5", Right - 1", Top and Bottom - 0.75".

2. The total number of reports (Soft bound) to be prepared are
   - One copy to the department
   - One copy to the concerned guide(s)
   - One copy to the candidate.

3. Before taking the final printout, the approval of the concerned guide(s) is mandatory and suggested corrections, if any, must be incorporated.

4. Every copy of the report must contain
   - Inner title page (White)
- Outer title page with a plastic cover
- Certificate in the format enclosed both from the college and the organization where the project is carried out.
- An abstract (synopsis) not exceeding 100 words, indicating salient features of the work.

5. The organization of the report should be as follows

| 1. Inner title page                      | Usually numbered in roman |
| 2. Abstract or Synopsis                  |                           |
| 3. Acknowledgments                       |                           |
| 4. Table of Contents                     |                           |
| 5. List of table & figures (optional)    |                           |

Chapters (to be numbered in Arabic) containing Introduction-, which usually specifies the scope of work and its importance and relation to previous work and the present developments, Main body of the report divided appropriately into chapters, sections and subsections.

The chapters, sections and subsections may be numbered in the decimal form for e.g. Chapter 2, sections as 2.1, 2.2 etc., and subsections as 2.2.3, 2.5.1 etc.

The **chapter must be left or right justified** (font size 16). Followed by the **title of chapter centered** (font size 18), **section/subsection numbers along with their headings must be left justified** with **section number and its heading in font size** 16 and **subsection and its heading in font size** 14. The **body or the text** of the report should have font size 12.

The figures and tables must be numbered chapter wise

The last chapter should contain the summary of the work carried, contributions if any, their utility along with the scope for further work.

**Reference or Bibliography:** The references should be **numbered serially** in the order of their occurrence in the text and their numbers should be indicated within square brackets for e.g. [3]. The section on references should list them in serial order in the following format.


Only SI units are to be used in the report. Important equations must be numbered in decimal form for e.g.

\[ V = IZ \quad \ldots \ldots \quad (3.2) \]

All equation numbers should be right justified.

Separator sheets, used if any, between chapters, should be of thin paper

**PROJECT EVALUATION:**

1. Relevance of the subject in the present context 10 mark
2. Literature Review 10 mark
3. Fabrication of the model/Data collection/repair and
   Overhauling work 30 mark
4. Originality of the work 10 mark
5. Results & Discussion 10 mark
6. Presentation(Minimum of 10 Slides) 30 mark

**TOTAL** 100 mark

**NOTE:** 1. The candidate declaration and certificate sample copy are enclosed here for incorporation in final project report
I A Marks:

Scheme of Evaluation

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NOTE: 1. Sesional marks to be awarded at the end of EACH SEMESTER ONLY

2. The candidate declaration and certificate sample copy are enclosed here for incorporation in final project report

---
CANDIDATE’S DECLARATION

I, ------------------------------------------ a student of Diploma in --------------------------
Department bearing Reg No------------------------------------------of ----------------------------------------
----- hereby declare that I own full responsibility for the information, results and conclusions
provided in this project work titled “-------------------------------------------------------------------------

----- “submitted to State Board of Technical Examinations, Government of Karnataka
for the award of Diploma in --------------------------.
To the best of my knowledge, this project work has not been submitted in part or full elsewhere
in any other institution/organization for the award of any certificate/diploma/degree. I have
completely taken care in acknowledging the contribution of others in this academic work. I
further declare that in case of any violation of intellectual property rights and particulars
declared, found at any stage, I, as the candidate will be solely responsible for the same.

Date:

Place: 

candidate

Signature of

Name: ----------------

Reg No-----------------
CERTIFICATE

Certified that this project report entitled "-" which is being submitted by Mr./Ms. .. Reg. No., a bonafide student of .. in partial fulfillment for the award of Diploma in ------ Engineering during the year .. is record of students own work carried out under my/our guidance. It is certified that all corrections/suggestions indicated for internal Assessment have been incorporated in the Report and one copy of it being deposited in the polytechnic library.

The project report has been approved as it satisfies the academic requirements in respect of Project work prescribed for the said diploma.

It is further understood that by this certificate the undersigned do not endorse or approve any statement made, opinion expressed or conclusion drawn there in but approve the project only for the purpose for which it is submitted.

Guide(s)
Name and signature

Examiners
1
2

Head of Department
ROADMAP FOR PROJECT GUIDES

1. The project work is proposed to be carried out during the V and VI semesters so that learners prepare during the V semester, do some field work based on the preparation during the mid semester vacation and report the analysis and inferences during the VI semester.
2. The learners would reach a level of maturity by the time they reach V semester and so a meaningful project lasting for a year can be executed by them.
3. To execute the project with involvement needs constant guidance and monitoring of the progress of the learners by the guide.
4. This does not mean teacher has to advice learners.
5. Be confident about the ability of the learner and “intellectually provoke” them with challenging questions. These questions should prompt the learners to search information and update themselves (to be carried out during the first two weeks).
6. Do not feed information to learners. Instead crate a ‘cognitive dissonance’ (a challenging question or situation that the learner is not able to find an immediate answer but feels the need to search for information to find a solution).
7. Defer judgement on learners and give them identified sources if required like a journal article, book or a web site.
8. Even if the learners report their inability to solve do NOT give or prescribe a solution.
9. Be patient and give time for the learner to construct his knowledge.
10. Give corrective feedback to the learner by challenging his solutions so that his logic is questioned and it develops further.
11. This leads to the first activity viz., literature survey and conceiving a project.
12. During this phase meet the project team in a group and create a healthy competition among the learners to search different sources and synthesise their findings in the group.
13. Aim for bringing out a workable innovative project conceived within the first eight weeks as given in the schedule attached.
14. During these two phases and the third phase the teacher should assess the strengths and weakness of the members of the group and allocate differential work to team members on the remaining tasks to be carried out during the next thirty weeks.
15. This is to ensure active participation of all the members of the team.
16. By the end of the twelfth week finalise the project and a schedule of further activities for each member indicating the time frame in which his activities are to be executed may be
made ready. A soft copy of this schedule may be collected from each learner by the guide to follow up.

17. This schedule prepared by each learner need to be documented for checking further progress of the project.

18. The next few phases of the project may require active guidance of the guide especially regarding the sources of collecting data, if a sample data is to be collected the number of units has to be decided, collating the data/fabricating, tryout/analysis and finally coming out with meaningful conclusions or models or application.

19. Data like models, designs, technical specifications, source code, protocols and original records need be collected from one authentic source as there will not be any variation. The teacher may guide the learners to authentic source.

20. Data having limited variability like product/service quality, processes and standards, procedures need to be collected from a sample as there is a variation. The number of units from whom (source) the data is to be collected is called sample. The sample needs to be representative of the expected variation. The decision on the size of the sample and the number of units need guidance from the teacher. For example, data regarding the quality of a product/service need be collected from 3 to 5 personnel at different levels of a service provider or dealers of a product. The numbers given are suggestive but a guide based on his experience has to make valid suggestions.

21. Data having a wide range of variation like customer satisfaction where the customers are members of the public need a larger number of units to accommodate the diversity. A tool like questionnaire with predetermined questions need to be prepared, tried out on a small sample and finalise the questions. Data may be collected from at least 30 units. This number is suggested to apply statistical analysis for meaningful conclusions. Guides may decide on the sample size depending on the accessibility of data.

22. The intention of the above three points viz., 19, 20 and 21 is to ensure objectivity in data collection i.e., to reduce the subjectivity of the human mind.

23. All the above activities need to be completed before three to four weeks before the end of V semester (refer the spread sheet related to scheduling).

24. The learners may be instructed to collect data objectively with identified sample during the next 4 to six weeks which includes the mid semester holidays. This would enable the learners to visit the field and collect data without the constraint of reporting to institution and attending classes on a regular basis.

25. The collected data need to be organised and entered to spread sheets or similar formats for analysis. Qualitative data may be converted to quantitative using a rating scale or similar data organisation procedures.

26. The result of most analysis on spreadsheet could be obtained in tables or graphs as per the requirement.

27. Activities mentioned in points 24, 25 and 26 may be carried out by learners during 4 to 8 weeks after commencement of VI semester.
28. Interpretation of the analysed tables and graphs to arrive at meaningful inference. The guide at this stage may defer his ideas on interpretation allowing the learners to do this. In case the learners err in the process they may be given corrective feedback.
29. A report of the whole process of doing the project may be written, word processed and submitted in triplicate.
30. Guides may contact industries and try to solve their problems so that the learners get a field experience and they get ready for the industry.
31. Innovations and innovative practices may be encouraged among the learners to be pursued as a project. Developing prototypes, (in simulation or real) trying out feasibility of new ideas, changing existing systems by adding modules, combining, assembling new modules and developing new systems may be given higher priority over routine bookish projects.
32. The schedule of events proposed is for an investigative project as a model. Guides may alter the prescribed schedule to suit the kind of innovative projects sited in point No.31 above.
33. Industry personnel may be involved in conceiving, executing and evaluating projects. This gives credibility to the institute and acceptance of learners for absorption into the company.

GUIDELINES TO LEARNERS TO CARRY OUT A TWO SEMESTER PROJECT

1. Carry out the project work through the V and VI semesters. Preparation must be done during the V semester and based on this, field work should be done during the mid semester vacation and reporting of analysis and inferences should be done in the VI semester.
2. You have the ability and the level of maturity needed to conceive an innovative and meaningful project accomplishing which gives you recognition by the industry and empowers you with the power of knowledge.
3. Understand your strength and weakness and make an effort to find the strength and weakness of other peers in the team.
4. Complement each other’s strength rather than compete with peers within the team. This will enable you to complete a comprehensive and innovative project relevant to the industrial needs rather than doing a routine copy of what others have done.
5. Seek guidance from the teacher and update him/her about the progress.
6. Be confident about your ability and that of other members of your group. Take extra efforts to collect information, share with your peers and synthesise your knowledge.
7. Question everything including the ideas of your teacher. Accept the ideas and instructions which are internally consistent (logical).
8. Involve actively in group activities and contribute towards the tasks.
9. Do not depend too much on the teacher as a source of information, search on your own and build your knowledge structure. Search for authentic sources like journal articles, books and authentic sites rather than blogs and tweets.

10. Though brief, record your thoughts and activities including searches immediately.

11. Prepare a schedule for your work on a spread sheet and encourage your peers to do the same.

12. Show your schedule and that of others to the teacher and get his feedback.

13. Keep reviewing the schedule every fortnight and take corrective steps if needed. For doing this keep the general guideline schedule given in the curriculum as a backdrop.

14. Tools used for data collection like instruments, testing machines, questions to be asked and software may be tried out and standardised by the twelfth week of the project. Seek the teacher’s help who is experienced in doing this.

15. Collect data dispassionately or objectively (without applying your personal prejudice). Complete this task before the VI semester begins.

16. While entering data into the spread sheet ask your peer member to verify. This will ensure accuracy of data entry.

17. Use appropriate mathematics/statistics for calculations. Seek help from external sources (other than your teacher) if required.

18. The results of your analysis need to be graphically represented and documented. You may also add photographs and video clips to increase the validity.

19. This task needs to be completed within 8 weeks after commencement of VI semester.

20. Interpret the data (after analysis) and arrive at meaningful inferences on your own in discussion with your peers. Get it ratified by your teacher. Suggestions from the teacher may be discussed among your peers and incorporated if they are internally consistent.

21. The project report may be word processed (videos, photographs attached in soft copy) and submitted in triplicate two weeks before the end of VI semester.

22. Involve passionately in the team work, make constructive contributions and come out with an industry friendly project which will equip you in your professional development.
LIST OF EXPERIMENT

1. Exercise on the operation of hand screw press
2. Die setting on power press
3. Exercise on power press
4. Exercise on blanking different profiles
5. Exercise on piercing and punching
6. Exercise on bending and forming exercise on notching and perforating
7. Exercise on notching and perforating
8. Exercise on slitting and lancing’
9. Die-setting on double action drawing presses
10. Exercise on shallow drawing deep drawing and re-drawing
11. Metal spinning of different types of articles
12. Preparation of spinning checks in teak wood by using wood turning lathe
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### FIRST SEMESTER DIPLOMA IN MECHANICAL ENGINEERING (Welding & Sheet Metal Engg.)

**Scheme of Study and Examination**
(with effect from 2009-2010)

<table>
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<th>Sl. No</th>
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<td>workshops/demos, guest lectures etc.</td>
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**Note:**
- *Question paper should be set and supplied by the Board of Technical Examinations*
- For practical, batch strength is limited to 15 to 20.

### SECOND SEMESTER DIPLOMA IN MECHANICAL ENGINEERING (Welding & Sheet Metal Engg.)

**Scheme of Study and Examination**
(with effect from 2009-2010)

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**Note:**
- For practical, batch strength is limited to 15 to 20.
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## Scheme of Study and Examination

**FOURTH SEMESTER DIPLOMA IN MECHANICAL ENGINEERING (Welding & Sheet Metal Engg..)**

(with effect from 2010 -2011 )

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**Practical /Drawing**

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# DIPLOMA IN MECHANICAL ENGINEERING
(WELDING AND SHEETMETAL TECHNOLOGY)
SCHEME OF STUDY AND EXAMINATION
WITH SEMESTER

W.E.F. 2011-12

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