CURRICULUM FOR

DIPLOMA IN

FABRICATION TECHNOLOGY

SEM I,II, III, IV, V, VI, VII & VIII

PROGRAMME STRUCTURE

SET II

Semester - I

Course code	Name of Course	TEACHING SCHEME				EXAMINATION SCHEME				Total marks
		L	T	P	C	Theory Marks		Practical Marks		
						TH	TM	PR/OR	TW	
GN101	Communication Skills	-	-	2	2	-	-	50	50	100
GN102	Engg. Maths-I	4	2	-	6	75	25	-	-	100
GN103	Applied Physics-I	4	-	2	6	75	25	-	50	150
GN104	Applied Chemistry	3	-	2	5	75	25	-	50	150
GN204	Engg. Drawing	2	-	4	6	-	-	50	50	100
Total		**13**	**2**	**10**	**25**	**225**	**75**	**100**	**200**	**600**

Semester - II

Course code	Name of Course	TEACHING SCHEME				EXAMINATION SCHEME				Total marks
		L	T	P	C	Theory Marks		Practical Marks		
						TH	TM	PR/OR	TW	
GN201	Engg. Maths-II	4	2		6	75	25	-	-	100
GN202	Applied Physics-II	4	-	2	6	75	25	-	50	150
GN203	Environmental Studies	3	-	-	3	75	25	-	-	100
GN205	Engg. Materials	4	-	-	4	75	25	-	-	100
GN105	Computer Fund. & App.	-	-	4	4	-	-	50	50	100
GN106	Basic Engg. Skills	-	-	6	6	-	-	50	100	150
Total		**15**	**2**	**12**	**29**	**300**	**100**	**100**	**200**	**700**

GN 101 COMMUNICATION SKILLS

1. RATIONALE

This course deals with Student's proficiency in English by developing their skills in reading, writing and speaking. They will be able to appreciate the usage of grammar. Acquiring proficiency in English is absolutely essential for effective communication while serving on the job. It also deals with applications of the concepts and principles learnt. Using visuals in written communication and body language in oral communication highly enhances the effectiveness of the communication process. These and some other important aspects are discussed in this course. The practice-feedback-practice cycle is of utmost important for developing the communication competencies/skills.

2. TEACHING AND EXAMINATION SCHEME

Course Code & Course Title	Periods/ Week (In Hours)			Total Credits	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
GN-101	**L**	**T**	**P**	**C**	**TH**	**TM**	**TW**	**PR/OR**	
Communication Skills		-	2	2	-	-	50	50	**100**

Minimum passing % : Practical 40%

Legends:

***L**-Lecture; **T** - Tutorial; **P** - Practical; **C**- Credit; **TH**- End Semester Theory; **TM** – Test Marks:*

***PR/OR** - End Semester Practical / Oral Examinations; **TW-** Term Work*

3. DETAILED COURSE CONTENTS

Unit 1 - Fundamental of Communication skills

Definition, components (message, sender, receiver, transmission medium and protocol), types(verbal & no-verbal, technological & non-technological, etc), importance of communication skills, effective communication skills (phatic stage, personal stage and intimate stage), barriers in effective communications(verbal, non-verbal), barriers while speaking, other barriers (individual's viewpoints, emotional block, etc.) methods of and hint to increase communication skills, body language.

Unit 2 – Presentation Skills

Methods and styles of presentations (seminars, speeches, etc), the plan, objectives, audience, structure (sequential, hierarchical, question oriented pyramid, meaty sandwich), tips for good beginning and end, aids to presentation (visual, verbal), delivery style (eyes, voice, expression, appearances, stance, etc), techniques for a good speech (repeat, draw (signs, pictures), jokes, etc).

Unit 3 - Technical Reports, Letter Writing, CVs

Functions of Reports (information, initiate action, recommend new procedures, recording, coordinating project), techniques (basic format, steps, appendices), types of reports (emphasis on progress reports, industrial visit reports, inspection reports, accident reports, survey report, report on seminars, workshop, technical gathering, etc).

Types of letters, format function, qualities of a good letter, examples of job applications, leave applications, complaints, purchase orders, enquiries replies etc.

Brief mention of importance of etiquette in email communication, importance of careful proofing the documents sent.

Curriculum Vitae – definition, sample, tips for a good CV, covering letter

Unit 4 - Soft Skills

Importance of values, attitude and etiquettes in communication, ethics and manners, courtesy, honesty and reliability; personal integrity, flexibility – adaptability, team skills – cooperation; ability to follow regulations; willingness to be accountable; Ability to relate to co workers in a close environment, non verbal communication, leadership skills – self directed, ability to direct and guide others, self-supervising; ability to relate to co workers in a close environment; positive attitude; positive work ethic, written communication Skills- basic spelling and grammar; reading and comprehension, personal hygiene and energy, interpersonal skills – communication skills with public, fellow employees, supervisors, and customers, motivation – willingness to learn; caring about seeing the company succeed; understanding what the world is all about; commitment to continues training and learning; critical thinking skills, grooming – good personal appearance.

Unit 5 - Language Workshop

The Reading, Listening, Writing, Speaking Skills will be tested

1. **Reading Skills:**

   Articles from the newspapers, magazines, journals etc. will be given to the students to read aloud thus checking their pronunciation, clarity and their style of reading.

2. **Listening Skills:**

   Passages, Topics, Stories, Speeches of eminent people will be read or played. The students have to listen and their listening skills will be tested.

3. **Writing Skills:**

   a) Students to write on any given topic

   b) Students to compose their own stories

   c) Students will be given a particulars situation i.e. accident, college gathering etc. and asked to write a report

4. Speaking Skills:

a) Students to speak on any given topic

b) Narrate a story written by them.

Group discussions in the classroom. This could include debates, discussion on current issues, role-playing.

4. List of Experiments :

- Oral presentation about technical products for five minutes.
- Seminar Presentation/Report writing and presentation on identified topics from science and technical subjects for short duration.
- Group discussion on science and technical topics.
- Organise mock interviews.
- Organise debates.
- Extempore speech for three minutes on a topic.
- Observe a process and reproduce orally in own words for three to five minutes.
- Arrange video recording of presentations for self-feedback.

5. SUGGESTED LEARNING RESOURCES

S.No.	Author	Title of Books	Year of Publication
1	Wren and Martin	Practical English Grammar	1992
2	John Sinclair (ed.),	Collins Cobuild English Grammar	William Collins & Sons Cp., London 1990
3	Krishna & Mohan,	Effective English Communication	Tata McGraw Hill, New Delhi 2000
4	Randolf, Quirk & Sidney Greenbaum	University Grammar of English	1993
5	Tiwari, N.P. et al ,	Communication Skills for Technical Students – Book	Somaiya Publications, 1995
6	Tiwari, N.P. et al,	A Communicative Grammar of English	Somaiya Publications, 1989

GN 102 ENGINEERING MATHEMATICS- I

1. RATIONALE

There are variable and constant concepts in the engineering phenomena and problems, which need to be understood, analyze and predict their behaviour. For instance, motion and acceleration of an object under applied known force, effect of temperature and pressure under constant volume, etc. All these situations require modeling of constants and variables into a relationship known as formula (formulating) and solving problems of engineering by substituting the values of constants and variables. Thus mathematics is used to understand, analyse and find solutions. There are some standard principles and formulae, which should be understood by students and apply as per needs of situations in real life.

2. TEACHING AND EXAMINATION SCHEME

Course Code & Course Title	Periods/ Week (In Hours)			Total Credits	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
GN-102	**L**	**T**	**P**	**C**	**TH**	**TM**	**TW**	**PR/OR**	
Engineering Mathematics	4	2	-	6	75	25	-	-	**100**

Minimum passing % : Theory 40%

Legends:

***L**-Lecture; **T** - Tutorial; **P** - Practical; **C**- Credit; **TH**- End Semester Theory; **TM** – Test Marks:*

***PR/OR** - End Semester Practical / Oral Examinations; **TW-** Term Work*

3. DETAILED COURSE CONTENTS

Unit 0 Fundamentals of algebraic mathematical operations

- Use of scientific calculator
- Recall of algebraic operations & formulae
- Solving of simultaneous equations with two variables

Unit 1 Co-ordinate Geometry/ Analytic Geometry;

Purposes/Applications of Co-ordinate Geometry. Coordinate systems. *Straight Line*- Distance between two points. Internal & external division of a line. Area of triangle. Slope of line. Angle between two lines. Various forms of equation of line-parallel to axis, point-slope form, slope intercept form, two point form, intercepts form & normal form. General equation of line. Distance of a point from a line. - Equations of circle, Equations of tangent & normal to circle.

Unit 2 Trigonometry

Purposes/Applications of Trigonometry. Radian. Radian & degree. Area of sector & length of an arc. Trigonometric ratios of any angle & Trigonometric identities. Trigonometric ratio of allied angles, compound angles, & Multiple angles(only 2A). Sum & product formulae. Sine, Cosine rules. Solution of triangles

Unit 3 Limits & Functions

Functions- constants, variables. Kinds of functions (question not to be asked). Concepts of limits- algebraic, trigonometric, logarithmic & exponential functions (No question on method of substitution and Inverse Trigonometric function)

Unit 4 Differential Calculus

Purposes/Applications of Differential Calculus. Definition of Derivative. Derivatives of standard functions-applications. Derivative of sum, difference, product & quotient of a function. Derivative of composite, implicit & parametric functions with reference to - algebraic, logarithmic, trigonometric, inverse circular functions, exponential functions & logarithmic differentiations. Introduction to Second order derivatives.

Unit 5 Application of derivatives

Geometrical meaning of derivatives. Equation of tangent & normal to curves. Derivatives as rate, motion, related rates. Maxima & minima.

4. SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)

Unit No.	Topic	Teaching Hours/ Semester	Marks
1	Co-ordinate Geometry	**14**	**20**
2	Trigonometry	**17**	**16**
3	Limits & Functions	**8**	**12**
4	Differential Calculus	**15**	**20**
5	Application of derivatives	**10**	**07**
		64	**75**

5. SUGGESTED LEARNING RESOURCES

S.No.	Author	Title of Books	Publication & Year
1.	Deshpande S.P.,	Mathematics for Polytechnics	Griha Prakashan, Pune, 1996 or latest
2.	Grewal B.S;	Engineering Mathematics	Khanna Pub., New Delhi1995 or latest
3.	Prasad, I.B.;	Engineering Mathematics	Khanna Pub., New Delhi1997 or latest
4.	TTTI, Bhopal	Mathematics for Polytechnics Vol. – I & Vol. – II	TTTI, Bhopal Latest
5.	Wartiker P.N.,	Applied Mathematics	Griha Prakashan Pune, 1996 or latest

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GN 103 APPLIED PHYSICS-I

1. RATIONALE:

Being the basis of all engineering branches, the students must acquire knowledge of basic principles; laws and facts of Physics This knowledge will improve their ability to apply it in solving engineering problems and overall growth of their disciplines.

2. TEACHING AND EXAMINATION SCHEME:

Course Code & Course Title	Periods/ Week (In Hours)			Total Credit	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
GN-103 Applied Physics I	**L**	**T**	**P**	**C**	**TH**	**TM**	**TW**	**PR/OR**	**150**
	4	-	2	6	75	25	50	-	

Minimum passing % : Theory 40% *Duration of Theory Paper: 3 Hrs.*

Legends:
***L**-Lecture; **T** - Tutorial; **P** - Practical; **C**- Credit; **TH**- End Semester Theory; **TM** – Test Marks:*
***PR/OR** - End Semester Practical / Oral Examinations; **TW-** Term Work*

3. DETAILED COURSE CONTENTS

Unit 1 UNITS & DIMENSIONS

Fundamental and Derived Physical Quantities and their SI units. Dimensions and Dimensional formula, Principle of Homogeneity, use of Dimensional Analysis for checking the correctness of an equation. Definition of least count of Vernier Caliper, Micrometer Screw Gauge.

Unit 2 KINEMATICS

Vectors and Scalars-Definition, Difference between vectors and scalars, types of vectors with example.
Definition - Displacements and distance, Velocity and speed, uniform and average velocity, Uniform acceleration and retardation, problems based on kinematic equations for uniform acceleration. $V=u+at$, $S=ut + \frac{1}{2} at^2$, $v^2 = u^2 + 2as$. Velocity- time diagram, Motion under gravity.

Unit 3 PROPERTIES OF MATTER

Definition of Elasticity, Stress, Strain and Elastic limit. Hooke's Law. Definition of Young's modulus, Bulk modulus, Rigidity modulus. Determination of Young's modulus by Searle's method. Behaviour of wire under continuously increasing stress. Definition of Yield Point, Breaking Stress, and Factor Of Safety. Adhesive and Cohesive forces. Angle of contact. Concept and definition of Surface Tension, Surface Tension by Capillary rise method. Application of Surface Tension. Definition and explanation of Viscosity. Statement of Newton's law of viscosity, Terminal Velocity (no derivation) Stokes Law. Determination of Viscosity by Stokes method. Streamlined and Turbulent flow. Definition of Critical Velocity, Reynolds Number.

Unit 4 HEAT

Definition of specific heat and units of specific heat. Modes of transfer of heat transfer, Conduction, Convection and Radiation. Law of thermal conductivity. Definition of co-efficient of thermal conductivity. Determination of coefficient of thermal conductivity of a good conductor

Statement of Charles's law, Boyle's law and Gay Lussac's law. Derivation of general gas equation.

Unit 5 ELECTROSTATICS

Coulomb's Law of Electrostatics, Electric Field, Intensity of Electric Field, Electric Potential and its unit, Potential difference between two points (no derivation), Potential of a sphere, Potential of Earth, Definition and units of Capacitance, Principle of Capacitor, Capacitors in series, Capacitors in Parallel.

Unit 6 MAGNETISM

Magnetic Effect of Electric current (Oersted's Experiment) Magnetic Field, Intensity of Magnetic Field. Coulomb's Law of Magnetism, Magnetic lines of Force, Magnetic Induction, Expression for Magnetic Induction at the centre of a Circular coil carrying current (no derivation), Force acting on straight conductor placed in Magnetic Field (no derivation).

Unit 7 (A) LAWS OF FORCES & FRICTION (MECHANICAL AND ALLIED GROUPS)

Triangle law of forces, parallelogram law of forces (expression only), graphical & analytical representation of force, resolution of forces, resolving force into rectangular components.

Definition & concept of friction, types of friction, Force of friction, Laws of static friction, Coefficient of friction, angle of friction (expression only), angle of repose(only qualitative aspects)

OR

UNIT 7(B) : SEMICONDUCTORS (ELECTRONICS AND ALLIED GROUPS)

Energy Band structure of electronic material(conductor , semiconductor and insulator)

Definition of semiconductors, types of impurities added to the semiconductors, intrinsic and extrinsic semiconductors.

Types of semiconductors P- type and N- type, Structure of P- type and N- type,

Extrinsic semiconductor using pure Si and Ge semiconductors.

Types of carriers; N- type and P- type

Process of recombination of carriers.

Formation of P-N junction and depletion region.

4.SUGGESTED SPECIFICATION TABLE WITH MARKS & HOURS (THEORY)

Unit No.	Unit	Teaching Hours / Semester	Marks
1	Units and Dimensions	5	5
2	Kinematics	9	12
3	Properties of Matter	13	14
4	Heat & Gas Laws	9	10
5	Electrostatics	12	12
6	Magnetism	8	10
7A	Laws of Forces & Friction	8	12
	OR		
7B	Semiconductors	8	12
	Total	**64**	**75**

7A-Mechanical and allied branches **7BFor Electronics and allied branches**

5. SUGGESTED LIST OF EXPERIMENTS

Sr. No.	LIST OF EXPERIMENTS
1	Use of Vernier Caliper
2	Use of Micrometer Screw gauge
3	Determination of Surface tension by capillary rise method using Travelling Microscope.
4	Determination of coefficient of viscosity by stroke's method.
5	Determination of acceleration due to gravity ('g') by simple pendulum.
6	Determination of Young's modulus by Searle's method.
7	Determination of Coefficient of thermal conductivity by Searle's method.
8A	Find resultant force using parallelogram of forces
8B	Draw and interpret band structure of Insulator, Semiconductor and conductor, Band structure of P-type & N-type extrinsic semiconductor, Drawing PN junction.

6. SUGGESTED LEARNING RESOURCES

Sr.No.	Author	Title	Publication and Year
1.	Halliday D and Resnickr	Physics Part-I & II	Latest
2.	Das S.K., Sisodiya M.L., Neher P.K., Kachhawa C.M.,	Physics Part-I & II for 10+2 Students	Latest
3.	B.G. Dhande	Applied physics for polytechnics	Latest
4.	Bhandarkar	Applied Physics for polytechnics	Latest
5.	Saxena HC & Singh Prabhakaer	Applied Physics Vol. I & II	Latest
6.	Rao, B.V.N.	Modern Physics	Latest
7.	R.K.Guar and S.L. Gupta.	Engineering Physics	Latest
8.	B.L. Thereja.	Engineering Technology	Latest
9.	Modern Publishers.	ABC of Physics	Latest
10.	V.K Mehta	Elements of electronic engineering	Latest
11	R S Khurmi	Applied Mechanics	Latest

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GN 104 APPLIED CHEMISTRY

1. RATIONALE

Applied Chemistry is multi-disciplinary science having wide applications in all the branches of engineering and technology. In simple terms, it is the science of chemical phenomena in various engineering situations. An understanding of the basic concepts of applied chemistry is essential not only for all chemists but also for engineers. Therefore it forms an indispensable base for them. The emphasis is given more on applications of principles of chemistry to engineering situations rather than fundamental principles only. It also develops in the students the habit of scientific enquiry, ability to investigate the cause and effect relationship, ability to interpret and analyze the results under given conditions.

2. TEACHING AND EXAMINATION SCHEME:

Course Code & Course Title	Periods/ Week (In Hours)			Total Credits	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
GN-104 Applied Chemistry	**L**	**T**	**P**	**C**	**TH**	**TM**	**TW**	**PR/OR**	**150**
	3	-	2	5	75	25	50	-	

Minimum passing % : Theory 40%

Legends:
***L**-Lecture; **T** - Tutorial; **P** - Practical; **C**- Credit; **TH**- End Semester Theory; **TM** – Test Marks:*
***PR/OR** - End Semester Practical / Oral Examinations; **TW-** Term Work*

3. DETAILED COURSE CONTENTS

Unit 1 Atomic Structure and Chemical Bonding

Fundamental particles and their characteristics, Energy levels - definition, designation of energy levels, Bohr- Bury's laws for distribution of electrons in shells (1^{st} three laws only), concept and shape of orbitals (s and p only), Quantum numbers-designation, definition, values, Aufbau and Pauli's Exclusion Principle, Hund's rule of maximum multiplicity, orbital electronic configuration of elements with atomic number 1 to 20, Lewis and Langmuir concept of stable configuration. Concept of electrovalent, covalent and co-ordinate bond, Formation, properties and examples of electrovalent compounds (NaCl, MgO, $CaCl_2$) covalent compounds (Cl_2, 0_2, N_2, $C0_2$)and coordinate compounds (0_3, $S0_2$).

Unit 2 Electrochemistry

Arrhenius theory of electrolytic dissociation., Degree of Ionisation- definition, factors affecting degree of ionisation , Nature of solute and solvent, concentration of solution, and temperature, Strong and weak electrolytes - definition and examples, Concept of the terms involved in electrolysis –conductor, insulator, electrolyte, non-electrolyte, electrolysis, electrodes, electrolytic cell, cathode, anode and current density, electrochemical series- concept and significance. Mechanism of electrolysis, Ionisation, primary reactions at the cathode, activity series of cations, primary reactions at the anode, activity series of anions, electrolysis of i. Fused NaCI using carbon electrodes, ii. aqueous NaCI using platinum electrodes iii. aqueous $CuS0_4$ using platinum electrodes iv. aqueous $CuS0_4$, using copper electrodes);

UNIT 3 Water and its treatment

Hard and soft water, types of hardness and its causes, disadvantages of hardness of water (i) for industrial use - dyeing, textile, sugar, paper, bakeries, (ii) in boilers for steam generation with special reference to sludge and scale formation (no chemical equations), zeolite and ion exchange process for water softening, desalination by electro dialysis and reverse osmosis, concept of pH

Unit 4 Corrosion and Its Control

Definition, Atmospheric corrosion (direct chemical corrosion) - definition, Oxidation corrosion, the nature of the oxide film, stable, unstable and volatile, mechanism of oxidation corrosion, corrosion due to other gases. Immersed corrosion (electrochemical corrosion) - definition, factors necessary for electrochemical corrosion , Galvanic cell corrosion, concentration cell corrosion- metal ion concentration and differential aeration. Mechanism of electrochemical corrosion- Hydrogen evolution mechanism, Oxygen absorption mechanism, Protection of metals from corrosion; galvanising, tinning, metal spraying , proper designing , using pure metals, using metal alloys, Cathodic protection- sacrificial anode and impressed current .Modifying the environment- De-aeration, De-activation, De-Humidification and alkaline neutralization.

Unit 5 Lubricants

Definition, functions of Lubricants, Types of Lubrication, Fluid Film, Boundary, Extreme Pressure, Classification of Lubricant - solid, semi- solid, liquid synthetic oils. Characteristics of Lubricants, Definition and Its significance -Viscosity. Viscosity Index, Flash and Fire Point, Oiliness, Pour Point, Volatility, Acidity, Emulsification and Saponification Value. Selection of Lubricants for Delicate Instruments, High Pressure and Low Speed Machines, Extreme Pressure and Low Speed Machines, Mechanisms of Lubrications.

4. SUGGESTED SPECIFICATION TABLE WITH MARKS & HOURS (Theory)

Unit No.	Name of the unit	Hours	Marks
1	Atomic Structure and Chemical bonding	10	15
2	Electrochemistry	08	13
3	Water and its treatment	09	15
4	Corrosion and its control	16	25
5	Lubricants	05	07
	Total	**48**	75

5. SUGGESTED LIST OF EXPERIMENTS

Sr. No.	Unit No.	List of Experiments
1.		Double titration of acid and base using phenolphthalein
2.		Double titration of acid and base using methyl orange
3.		Redox titration of potassium permaganate, ferrous sulphate and oxalic acid.
4.		Determination of degree of hardness of water by EDTA method
5.		Determination chloride content of water by Mohr's method
6.		Determination of total alkalinity of water sample
7.		Titration of strong acid and strong base using pH meter
8.		Determination of conductivity of water
9.		Titration of strong acid and strong base using conductometer
10.		Corrosion susceptibility of aluminium to acid or base.

6. SUGGESTED LIST OF ACTIVITIES

S.No.	Title
1.	Quiz on Electronic configuration of atoms.
2.	Demonstration of process of electrolysis
3.	Demonstration of purification of water by domestic/economical method.
4.	Identification and application of lubricants in different equipment/glasswares used in different laboratories
5.	Visit to some metallurgical industries for demonstration of different processes of metallurgy.
6.	Preparation of chart of different alloys of steel and their uses
7.	Seminar on different aspects of fuel, properties and usages
8.	Use of pH paper for testing different samples of water, blood etc.
9.	Demonstration and use of different samples of paints, varnishes, drying oils, pigments, thinners, dryers, fillers, plasticizers and anti-skinning agents.

7. SUGGESTED LEARNING RESOURCES

Sl. No.	Author	Title	Publication and Year
1.	M.M. Uppal	A text book of Engineering Chemistry,	Khanna Publishers
2	V.P. Mehta	A textbook of Engineering Chemistry,	Jain Bros. Delhi
3	S.N. Narkhede	A Textbook of Engineering Chemistry	Nirali Prakashan
4	R.A. Banawat, S.K. Mahajan, S.K.Mehta	Textbook of Applied Chemistry	India Book House
	V.S. Godbole	Applied Chemistry	
5	R.S. Sharma	Textbook of Engineering Chemistry	Khanna Pubnlishers
	P.C. Jain and M. Jain	Engineering Chemistry	
6	J.C. Kuriacose and J. Rajaram	Chemistry in Engineering	Tata McGraw Hill Publishing Co.Ltd., New Delhi
7	Dr.S. Rabindra and Prof.B.K. Mishra	Engineering Chemistry:	Kumar and Kumar Publishers (P) Ltd., Bangalore -40
8	S.S.Kumar	A Text book of Applied Chemistry-I	Tata McGraw Hill, Delhi
9	Sharma	A Text book of Applied Chemistry -I	Technical Bureau of India, Jalandhar
10	S.S.Dhara	A Textbook of Engineering chemistry	S.Chand & Company, New Delhi
11	Dr. G.H. Hugar	Progressive Applied Chemistry – I & II	Eagle Prakashan, Jalandhar

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GN 204 ENGINEERING DRAWING

1. RATIONALE:

Drawing is a graphical language of engineering field. Engineering technician irrespective of his field of operation in an industry is expected to possess a thorough understanding of drawing, which includes clear spatial visualization of objects and the proficiency in reading and interpreting a wide variety of engineering drawings. It is the skill, which translates an engineering idea into lines and dimensions on a piece of paper. Besides this he is also expected to possess a certain degree of drafting skill- depending upon his job functions-in his day-to-day activities. This course of Engineering Drawing for Diploma courses is aimed at developing basic knowledge and skills of engineering drawing and use of computer in the field of Engineering Drawing.

2. TEACHING AND EXAMINATION SCHEME:

Course Code & Course Title	Periods/ Week (In Hours)			Total Credits	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
GN-204	**L**	**T**	**P**	**C**	**TH**	**TM**	**TW**	**PR/OR**	
Engineering Drawing	2	-	4	6	-	-	50	50	**100**

Minimum passing % : Theory 40% and Practical 40% *Duration of Theory Paper: 3 Hrs.*

Legends:

***L**-Lecture; **T** - Tutorial; **P** - Practical; **C**- Credit; **TH**- End Semester Theory; **TM** – Test Marks:*

***PR/OR** - End Semester Practical / Oral Examinations; **TW-** Term Work*

3. DETAILED COURSE CONTENT

Unit 1 Introduction

- Importance of Engineering drawing as a means of communication.
- Introduction to drawing equipment, instruments and their uses.
- Planning of drawing sheet as per I.S. 696 - 1972.
- Indian standard practices of laying out and folding of drawing
- Different types of lines used in engineering drawing.
- Importance of scale in Engineering Drawings.
- Lettering

Unit 2 Dimensioning techniques and standard conventions

- Methods of dimensioning, Dimensioning terms and notation (use of I.S. code 696 and 2709), General rules for dimensioning, Dimensioning of cylinder, holes, arcs of circle, narrow space, angles, counter sunk hole, screw thread, taper etc.
- Conventional representation of various materials.

Unit 3 Engineering Curves & Shapes

- Construction of an Equilateral and Isosceles triangle,Square,Rhombus,Regular pentagon & Regular hexagon given distance across the corners/ flats and given length of a side using general method of construction
- Types of Engineering curves
- Construction of Engineering curves like
  - Ellipse- by focus & directrix method and arcs of circles method
  - Parabola- by focus & directrix method and rectangule or oblong method
  - Hyperbola- by transverse axis & Focus and directrix method
  - Cycloid- by generating circle rolling on a straight line
  - Involutes of a triangle ,circle & pentagon
  - Draw normal & tangents to the above curves from given point on the curve
- Practice problems of drawing various engineering curves

Unit 4 Orthographic projection

- Definitions of various terms associated with orthographic projections.
- Planes of projections.
- Concept of Quadrants.
- First and third angle method of projection.
- Projection of points
- Projection of lines
  - (i) Parallel to both Principal planes
  - (ii) Parallel to one and Perpendicular to other Principal plane.
  - (iii) Inclined to one plane and parallel to other plane.
- Projection of Triangle, Square, Rhombus, regular Pentagon when inclined to one principal plane & perpendicular to other plane.
- Introduction to the following solids
  Cylinder, cone, cube.

  Right regular solids such as

  (i) Prism: Triangular & Square
  (ii) Pyramid: Square & Pentagonal.
    - Projections of above mentioned solids when axis is inclined to one principal plane & Parallel to other principal plane.
    - Conversion of simple pictorial views into orthographic views.

- Practice problems on projection of points, lines and planes.
- *Problems where one end of the line is in one quadrant & other end in other quadrant and traces are to be excluded.*
- *Problems where apparent projection of plane are given, true shape & slope angle are to be drawn are excluded.*

Unit 5 Section of solids

- Concept of sectioning planes
- Auxiliary planes and true shape of section.
- Drawing projections and section of solids like square prism, square pyramid, pentagonal pyramid, cylinder and cone with sectioning plane inclined to one principal plane and Perpendicular to the other principal plane (Axis of solid perpendicular to one principal plane and parallel to the other)

Unit 6 Development of lateral surfaces

- Concept and importance of surface development in the engineering field.

  Methods of development of surfaces-Radial & Parallel line method.

  Development of surfaces for the following right regular solids-
- Cylinder
- Prism
- Cone
- Pyramids
- Development of solids standing on its base & cut by a plane inclined to either VP/HP and perpendicular to the other is also included.
- *Practice problems on above with top & bottom of the solid is excluded*

Unit 7 Isometric Views

- Limitations of orthographic projections.
- Procedure for preparing isometric projections.
- Difference between Isometric projection & Isometric view.
- Isometric view of geometrical solids and simple machine parts.
- Conversion of orthographic views into isometric views.
- Construction of Isometric view for any real object. Conversion of orthographic views of simple components into isometric views.

4. SUGGESTED SPECIFICATION TABLE WITH MARKS & HOURS

Unit No.	Unit	Teaching Hours / Semester
1	Introduction	**1**
2	Dimensioning techniques & standard conventions	1
3	Engineering Curves & Shapes	4
3	Orthographic projections	**13**
4	Section of solids	3
5	Development of surfaces	4
6	Isometric projections	2
-	Revision	4
	Total	**32**

5. SUGGESTED LIST OF ACTIVITIES

Following shall be the list of sheets to be prepared as Engineering drawing lab work

Sheet No.	TITLE	Contents	Hours
1.	TYPES OF LINES, LETTERING, DIMENSIONING.	All types of lines, Single stroke vertical capital letters, Methods of Dimensioning-Aligned & unidirectional System, Conventional representation of materials.	4
2.	GEOMETRICAL CONSTRUCTIONS	Construction of Equilateral and Isosceles triangle, Square, Rhombus, Regular pentagon & hexagon	4
3.	ENGINEERING CURVES	Construction of ellipse, parabola, hyperbola by given methods. Involutes, cycloid. Draw normal and Tangent to curves.	8
4.	PROJECTION OF POINTS & LINES	Drawing projection of points in all 4 quadrants. Drawing of projections of lines in following positions (i) Parallel to both Principal planes (ii)Parallel to one and Perpendicular to other Principal plane. (iii) Inclined to one plane and parallel to other plane.	6
5	PROJECTION OF PLANES	Drawing the projection of Triangle square, Rhombus, regular Pentagon when inclined to one principal plane & perpendicular to other plane.	6
6	PROJECTIONS OF SOLIDS	Drawing projection of following solids Cylinder, cone, cube. Right regular solids such as Prism: Triangular & Square,Pyramid: Square & Pentagonal,when axis is inclined to one principal plane & parallel to other principal plane.	8
7	ORTHOGRAPHIC PROJECTIONS	Simple problems on conversion of pictorial into orthographic views.(atleast 2 problems each in 1st angle and 3rd angle)	4
8	SECTIONS OF SOLIDS	Drawing projections and section of solids like square prism, square pyramid, pentagonal pyramid, cylinder and cone with sectioning plane inclined to one principal plane and Perpendicular to the other principal plane (Axis of solid perpendicular to one principal plane and parallel to the other)	8

9.	DEVELOPMENT OF LATERAL SURFACES	Draw the Development of surfaces for the following right regular solids- Cylinder, Cone, Prism & pyramids (square, triangular, pentagonal).	8
10	ISOMETRIC VIEWS	Conversion of orthographic views of simple components into isometric views.	8

6. SUGGESTED LEARNING RESOURCES

S.No.	Author	Title	Publisher
1.	BIS, India	IS. 696. (Latest revision).	BIS, India
2.	N.D. Bhatt	Engineering Drawing	Charoter Publisher,Anand
3.	R. K. Dhawan	Engineering Drawing & Machine Drawing	Kumar
4.	R.B. Gupta	Engineering Drawing	Satya Prakashan, Delhi
5.	P.S. Gill	Geometrical Drawing	Ketson & Sons
6.	P.S. Gill	Machine Drawing	Ketson & Sons
8.	TTTI, Bhopal	Work Book in Mechanical Drafting	TTTI, Bhopal
9.	T. Jeyapoovan	Engineering Drawing & Graphics Using AutoCAD 2000	Vikas Publishing House Pvt. Ltd, New Delhi.
10	N.D. Bhatt	Machine Drawing	Charoter Publisher,Anand

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SEMESTER II

GN-105 - COMPUTER FUNDAMENTALS & APPLICATIONS

1. RATIONALE

The course on Computer Fundamentals & Applications will enable the students to understand the basic concepts related to computer fundamentals, Data Representation & Number Systems, Computer Languages, operating system, Computer Software and Internet Technology and will be able to apply the same in different areas of electronics engineering. Laboratory practice will help in developing the requisite skills.

2. TEACHING AND EXAMINATION SCHEME

Course Code & Course Title	Periods/ Week (In Hours)			Total Credits	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
GN-105	**L**	**T**	**P**	**C**	**TH**	**TM**	**TW**	**PR/OR**	
Computer Fundamentals & Applications	-	-	4	4	-	-	50	50	**100**

Minimum passing % : Theory 40%

Legends:
***L**-Lecture; **T** - Tutorial; **P** - Practical; **C**- Credit; **TH**- End Semester Theory; **TM** – Test Marks:*
***PR/OR** - End Semester Practical / Oral Examinations; **TW-** Term Work*

3. DETAILED COURSE CONTENTS

UNIT 1 Computer Fundamentals

1.Introduction to Computer

2. History, Evaluation, Classification and Generations of computers

3.Organisation of the Computer System

4. Hardware

Input device, Memory or Storage Devices, Processing Unit, Output device, Scanner

Printers.

5. Communication technology and evolution of communication mediums

6. Software

System software

Application Software

Shareware

Freeware

Open Source

7. Concept of Computer Viruses

Definition

Types

Preventive Measures

UNIT 2 Operating System

1. Introduction to operating system

Definition Functions , Types, Examples, Comparisons of Various Operating Systems

2. Windows Operating System-

GUI(Graphical user Interface), desktop, Start Menu, Task Bar, Status Bar, Scroll Bar, Title Bar, Toolbar, Menu Bar. File Organization: Creating, Saving, Deleting, Renaming, Cutting, Pasting, copying, moving, Searching Files and Folders. Applications: My Computer, Recycle Bin, Windows Explorer, Control Panel.

UNIT 3 Application Software

1. MS Word

- Introduction
  - Starting MS Word
  - Creating, saving and opening a document
  - Editing commands-Cut, Copy, Paste, Paste Special
  - Text Formatting, Bullets and Numbering, Borders and shading etc.
  - Tabs, Style, Views
  - Insert Table, Picture, OLE Objects, etc.
  - Checking Spelling and Grammar, Thesaurus
  - Page Layout & Printing
  - Mail Merge**.**

2. MS Excel

- Create, Save and open a worksheet
- Entering data – text, numbers and formulae in a worksheet, Hyperlink
- Navigating within a Worksheet and also between different Worksheets of a Workbook
- Inserting and deleting cells, rows and columns in a worksheet
- Select, copy, paste and delete cell data within the worksheet

- Using various formulae and inbuilt functions like Trigonometric, Statistical, Logical, Data Sorting
- Update worksheets using special tools like spell check and auto correct.
- Setup the page and margins of worksheets for printing
- Enhance worksheets using charts & graphs

3. MS Power Point

- Introduction and starting the program
- Starting a presentation
- Adding new slide
- Saving and Opening presentation
- Text formatting options
- Copy, Move and delete slides and text
- Applying designs
- Using Animations
- Slide Transitions, Hyperlink
- Insert clip art
- Viewing the presentation

UNIT 4 The Internet

Networks, Advantages of networking, Types of networks.

- History and Functions of the Internet
- Working with Internet
- Web Browsers, World Wide Web, Uniform Resources Locator and Domain, Names, Issues related to web security.
- Uses of Internet
- Search for information, Email, Chatting, Instant messenger services, News Group, Teleconferencing, Video-Conferencing, E-Commerce and M-Commerce.

Email

- Manage an E-mail Account
  E-mail Address, Configure E-mail Account, log to an E-mail, Receive E-mail, Sending mails, sending files an attachments and Address Book
- Downloading Files

4. SUGGESTED LIST OF EXPERIMENTS

S. No.	Unit No.	List of Experiments
1	**1**	Identify Input and output devices
2	**1**	Calculate capacity of different storage device
3	**2**	Identify OS and different application software s loaded on that OS

4	**3**	Load Windows operating system. Configure and load relevant device drivers
5	**4**	Practice on Windows 95/98/2000 ; o Starting Windows, Exploring the desktop, Arranging windows, My Computer, The start button, Creating Shortcuts, Practice on moving and sizing of windows o Study of file organization: creating, copying, moving, renaming and deleting o Practice on Windows Accessories- Notepad, Word Pad and Paint o Editing document & formatting text, Previewing and printing document/Image file o Practice on Windows Explorer **o** Recycle bin **o** Shutting down windows
6	**4**	Practice on MS-Word ; o Create and format document o Edit and Modify text- changing font size type and style o AutoText, AutoComplete, AutoCorrect, grammar and spellchecker, Find and replace of text o Open save and print a document o Insert, modify table o Insert graphics o Mail merge
7	**5**	Practice on Microsoft Excel o Create, save & format worksheet o Open and save worksheet file o Edit & modify data o Use formula and functions o Split windows and freeze pans o Data sort and security features o Create, edit, modify and print worksheet. o Create and edit charts
8	**5**	Practice on PowerPoint o Create, edit, insert, move, slides o Open and save presentation o Insert picture, audio slide layout, action button o Apply custom animation o Present slide show
9	**6**	Practice on: o Identification of type of Account. o Connecting to internet o Dial up access o Web browsing o Searching websites o Information searching o Email services **o** Creating email accounts & Receiving and sending mails

5. SUGGESTED LEARNING RESOURCES

S.No.	Author	Title of Books	Publication & Year
1	Norton Peter	Introduction to Computers (special Indian edition)	Tata McGraw Hills New Delhi, 6th Edition, 2005 ISBN: 0070593744
2	Kahate Atul	Information Technology	Tata McGraw Hills New Delhi, ISBN-13:9780070593718
3	Williams Stalling	Using Information technology: A Practical Introduction to Computers and Communication	Tata McGraw Hills New Delhi,
4	Curtin	Information Technology: The Breaking Wave (book only)	Tata McGraw Hills New Delhi, ISBN:0074635581
5	Ravichandran, D	Introduction to Computers and Communication	Tata McGraw Hills New Delhi, ISBN: 0070435650
7	Douglas E.	The Internet Book	Prentice Hall of India, New Delhi, 3rd Edition, ISBN: 812032286X
8	Basanbhara S.K.	Computer Today	Nita Mehta Publications, 2003 ISBN: 8186340742

GN 106 BASIC ENGINEERING SKILLS

1. **Rationale**:

A technician is expected to work on the shop floor. It therefore becomes essential for him to have a through exposure to safety aspects, fire fighting, first aid as he is the guide for the skilled and unskilled personnel working under him. From technical knowledge and skills point of view he is also expected to have knowledge on proper ways of using various hand tools, measuring devices etc. in addition to other engineering skills.

The course on Basic Engineering skills is aimed at providing him the knowledge and skills in all those areas through shop instructions, demonstrations and skill development exercises. This course is also aimed at providing the student the exposure to engineering equipment which will help him to assimilate the teaching which takes place at higher semesters.

2. **Teaching And Examination Scheme**

Course Code & Course Title	Periods/ Week (In Hours)			Total Credits	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
(GN106) Basic Engineering Skills	L	T	P	C	TH	TM	PR/OR	TW	150
	0	0	6	6	-	-	50	100	

Legends: L-Lectures; P-Practical; C-Credits; TH-End Semester Theory; TM-Test Marks;

PR/OR-End Semester Practica/Oral Examinations TW- Term Work

3. **Detailed Course Contents**

Unit 1: General Safety, Housekeeping, Fire Fighting & First Aid Introduction to General Safety aspects of engineering workshop, meaning and importance of housekeeping, possible fire hazards, fire triangle, types of fire extinguishers – selection and use, basic knowledge of first aid with specific inputs on cuts, burns, electric shocks, artificial respiration, handling emergencies.
Unit 2: Fitting Workshop Practice Introduction to the trade, Introduction to various hand Tools, Measuring and Marking Tools, cutting tools, Holding tools, Striking tools, Types of files and filing methods. Drill bits and drilling Processes, using portable and pillar drilling machine. Operations performed in fitting shop such as measuring, marking, chipping, filing, grinding, sawing, drilling tapping and deing. Use of spirit level and plumb bob.
Unit 3: Carpentry Workshop Practice Introduction to the trade, types of wood and its characteristics, forms of wood, defects in timber and its identification, wood working hand tools, wood working processes. Different types of joints and their usage. Introduction to wood working machines- lathe , circular saw, band saw, wood planner, universal wood working machine.
Unit 4: Electrical Workshop Practice

Brief introduction to power distribution, different hand tools used in electrical trade, different measuring instruments. Making of cable joints. Measurement of current, voltage, frequency and Power Consumption. Connecting and starting of Induction Motor. Changing of Direction of rotation of induction motor. Introduction to commonly used electrical Fittings (Domestic & Industrial). Reading of simple electrical drawings.
Unit 5: Basic Electronics Workshop Practice Introduction to basic electronic components, Introduction to use of Multimeter in measuring voltage, current, resistance, capacitance. Checking of connectivity. Introduction to soldering process. Soldering Irons- Types and wattage. Reading of basic electronic circuits.

Note: during first 20 minutes of the practical session, Instructor shall provide theoretical knowledge as prescribed in the curriculum. (Shop Talk)

Unit No.	Topic	Hours/ Semester
1.	General Safety, Housekeeping, Fire Fighting & First Aid	06
2.	Fitting Workshop Practice	36
3.	Carpentry Workshop Practice	18
4.	Electrical Workshop Practice	18
5.	Basic Electronics Workshop Practice	18
	Total	**96**

GN201 ENGINEERING MATHEMATICS- II

1. RATIONALE :

Mathematics is the backbone of all areas of engineering and technology and hence technician / engineers need to study relevant theories and principles of mathematics to enable them to understand and grasp the concept of advance courses of the curriculum. With above in mind, the necessary content for the engineering mathematics is derived to understand advance use of mathematics in solving engineering problems.

2. TEACHING AND EXAMINATION SCHEME :

Course Code & Course Title	Periods/ Week (In Hours)			Total Credits	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
GN-201 Engineering Mathematics-II	**L**	**T**	**P**	**C**	**TH**	**TM**	**TW**	**PR/OR**	**100**
	4	2	-	6	75	25	-	-	

Minimum passing % : Theory 40% *Duration of Theory Paper: 3 Hrs.*

Legends:
***L**-Lecture; **T** - Tutorial; **P** - Practical; **C**- Credit; **TH**- End Semester Theory; **TM** – Test Marks:*
***PR/OR** - End Semester Practical / Oral Examinations; **TW-** Term Work*

3. DETAILED COURSE CONTENT :

Unit 1 Determinants
Determinants of the second order and third order, solutions of equations in two or three variables using Cramer's Rule

Unit 2 Binomial Theorem - Binomial Theorem for a rational index, general term of binomial expansion, middle term (s).

Unit 3 Mensuration - Volume and surface area of - Prism, pyramid, frustrum of a sphere, frustrum of pyramid, frustrum of cone, Area and volume by Simpsons Rule

Unit 4 Matrices
Definition and Notations,

Elements of Matrix, Types of matrices, Special matrices - Square, Diagonal, Row, Column, Scalar Unit, Zero or null, upper and lower triangular matrices, Symmetric, Skew symmetric matrices . Addition, Subtraction and multiplication of matrices, Inverse of matrix using Adjoint method only Application of matrices in solving simultaneous equations in 2 or 3 variable.

Unit 5 Integral Calculus
Definition, fundamental properties. Methods of Integration - Integration by substitution, Integration by parts, Integration by partial fractions.. Definition of Definite Integral Properties of definite integrals, Application of integration**,** area under a plane curve, volume of revolution.(simple sums only)

Unit 6 Differential Equations

Definition, order and degree of a differential equation, solutions of differential equations of first order and first degree-variable separable type only. Second order differential equation of type $d^2y/dx^2 = f(x)$ only, Application of differential equation in engineering problems
Unit 7 Statistics (Mechanical and Allied Engg. Branches) . Measures of central tendency for grouped and ungrouped data - Mean, Median and Mode . Measures of dispersion for grouped and ungrouped data -range , mean deviation, standard deviation, variance and co-efficient of variation
OR
Unit 7 Complex Numbers. (Electronics engg and Allied branches) Definitions, Argand diagrams , polar form of a complex number, Addition, Subtraction, Multiplication & Division of a complex number. Exponential and circular function, De-moivres theorem, roots of a complex number- Cube roots of unity, n th roots of unity, , hyperbolic functions

4. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (THEORY):

Unit No.	Topic	Teaching Hours/ Semester	Marks
1.	Determinants	**5**	**7**
2.	Binomial Theorem	**7**	**10**
3.	Mensuration	**7**	**10**
4.	Matrices	**11**	**08**
5.	Integral Calculus	**17**	**20**
6.	Differential equations	**08**	**10**
7.	Statistics	**09**	**10 $**
	OR		
7	Complex Numbers	**09**	**10 #**
	Total :	**64**	**75**

$- for Mechanical and allied branches

 # - For Electronics and allied branches

5. SUGGESTED LEARNING RESOURCES :

S.No.	Author	Title of Books	Publication & Year
6.	Deshpande S.P,	Mathematics for Polytechnics	Griha Prakashan, Pune, 1996 or latest
7.	Grewa, I B.S;	Engineering Mathematics	Khanna Pub., New Delhi1995 or latest
8.	Prasad, I.B.;	Engineering Mathematics	Khanna Pub., New Delhi1997 or latest
9.	Wartiker P.N.,	Applied Mathematics	Griha Prakashan Pune, 1996 or latest

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GN 202 APPLIED PHYSICS-II

1. RATIONALE:

Physics is one of the basic building blocks for engineering sciences. Therefore, the students need to describe and explain the basic principles, laws & facts of physics. These skills will enhance their ability to apply it in solving engineering problems related to their respective branches of engineering

2. TEACHING AND EXAMINATION SCHEME:

Course Code & Course Title	Periods/ Week (In Hours)			Total Credits	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
GN-202 Applied Physics-II	**L**	**T**	**P**	**C**	TH	**TM**	TW	PR/OR	**150**
	4	-	2	6	75	25	50	-	

Minimum passing % : Theory 40% and Practical 40% *Duration of Theory Paper: 3 Hrs.*

Legends:
***L**-Lecture; **T** - Tutorial; **P** - Practical; **C**- Credit; **TH**- End Semester Theory; **TM** – Test Marks:*
***PR/OR** - End Semester Practical / Oral Examinations; **TW-** Term Work*

3. DETAILED COURSE CONTENTS

Unit 1 FORCE, WORK, POWER, AND ENERGY

Definition of Force and its units. Types of Forces with example- Direct, Remote action e.g. Gravitational Force, Magnetic Force, Electric Force. Effect of Forces on body-External, Internal.

Work-definition and units, Graphical Representation of workdone, Energy definition and units.

Types of Mechanical Energies- K.E. & P.E. Law of Conservation of Energy, Total Energy, Power-definition and units, Power (Force X Velocity)

Unit 2 CURRENT ELECTRICITY

Ohms law, General equation of Ohms law, Factors affecting resistance, specific resistance and units. Effect of temperature on resistance, Law of resistance in series and parallel. Internal resistance and EMF of the cell. Potential drop along a uniform wire. Principle of potentiometer. Comparison of EMF of a given cell by single cell method. Camparision of EMF of a given cell by sum and difference method. Use of meter bridge to determine the unknown resistance.

Definition of Electric power and energy in d.c. circuit. Concept of Kilowatt hour, calculation of energy bills.

Unit 3 ELECTROMAGNETISM

Electromagnetic Induction, Faraday's Laws of Electromagnetic Induction, Lenz's Law, Self Induction & Mutual Induction.

Unit 4 LOGIC GATES

Introduction to Binary Number System, Concept of '0' and '1' in Binary System. Binary equivalent of Decimal numbers from 0 to 10

Logic Gates: 1. 'NOT' Gate , 2. 'OR' Gate 3. 'AND' Gate. NAND , NOR GATE Their Logic Representation & Truth Table

Unit 5 SOUND

Definition and examples of Free and Forced Vibrations, Resonance. Determination of velocity of sound using Resonance Tube.

Definition of Beats (No derivation), Beat frequency & application of Beats, Definition of Echo, Reverberation & Reverberation time, Sabine's Formula, Acoustical Planning of an Auditorium. Factors affecting Reverberation Time, Ultrasonic waves, Piezo Electric Effect, Applications of Ultrasonic waves.

Unit 6 CIRCULAR MOTION AND GRAVITATION

Defination of Uniform Circular Motion, Angular Displacement, Angular Velocity, Relation between Linear and Angular velocity, Defination and concept of Centripetal and Centrifugal Force.(No derivation), Expression for velocity of a vehicle moving on a curved Horizontal Road, Expression for Angle of Banking & Super Elevation of Road. Newton's Law of Gravitation, Force of Gravity. Acceleration due to Gravity, Expression for Acceleration due to gravity.

Unit 7(A) FUNDAMENTAL CONCEPTS OF SIMPLE MACHINES (MECHANICAL AND ALLIED GROUPS)

Definition of efforts, velocity ratio, mechanical advantage & efficiency of machine and their relationship. Laws of machines, examples of simple machine, definition of ideal machine, systems of pulleys (First & Second). Determination of velocity ratio ,Mechanical Advantage & Efficiency.

OR

Unit 7 (B) RECTIFIERS (ELECTRONICS AND ALLIED GROUPS)

V-I characteristics of P-N junction. Diode as a rectifier. Half wave rectifiers, working, input and output waveforms, percentage regulation,((V NL – V FL) / V FL)x 100

Full wave rectifier with centre tap transformer, working, input and output waveforms, percentage regulation

Bridge rectifier, working, input and output waveforms, percentage regulation

4. SUGGESTED SPECIFICATION TABLE WITH MARKS & HOURS(THEORY)

Unit No.	Unit	Teaching Hours / Semester	Marks
1	FORCE, WORK,POWER & ENERGY	10	12
2	CURRENT ELECTRICITY	16	16
3	ELECTROMAGNETISM	6	8
4	LOGIC GATES & AWARNESS TO NANO SCIENCE	4	6
5	SOUND	8	9
6	CIRCULAR MOTION & GRAVITATION	10	12
7A	FUNDAMENTAL CONCEPTS OF SIMPLE MACHINES	10	12
	OR		
7B	RECTIFIERS	10	12
	Total	**64**	**75**

7A- for Mechanical and allied branches **7B- For Electronics and allied branches**

4. LIST OF EXPERIMENTS

1. Determination of Specific resistance of a material wire by Voltmeter and Ammeter.
2. Determination of Internal resistance of a given cell by using Potentiometer.
3. Calibration of Voltmeter by using Potentiometer.
4. Comparison of E.M.F. of two given cells by single cell method using potentiometer.
5. Determination of specific resistance by meter bridge.
6. Verify the law of resistances in series by meter bridge.
7. Verify the laws of resistances in parallel by meter bridge.
8. Determination of velocity of sound by Resonance tube.

5. SUGGESTED LEARNING RESOURCES

S.No.	Author	Title	Publication and Year
1.	Halliday D and Resnickr	Physics Part-I & II	Latest
2.	Das S.K., Sisodiya M.L., Neher P.K., Kachhawa C.M.,	Physics Part-I & II for 10+2 Students	Latest
3.	B.G. Dhande	Applied physics for polytechnics	Latest
4.	Bhandarkar	Applied Physics for polytechnics	Latest
5.	Saxena HC & Singh Prabhakaer	Applied Physics Vol. I & II	Latest
6.	Rao, B.V.N.	Modern Physics	Latest
7.	R.K.Guar and S.L. Gupta.	Engineering Physics	
8.	B.L. Thereja.	Engineering Technology	
9.	Modern Publishers.	ABC of Physics	
10.	V.K Mehta	Elements of Electronic Engineering	

GN203 ENVIRONMENTAL STUDIES

1. RATIONALE

Due to various developmental activities carried out by man, our environment is continuously being abused and getting degraded. The air we breathe, water we drink, food we eat, land we live on, all are getting spoiled day by day. The purity of our environment is of prime importance for survival of human race on the earth. Man should not go for developmental activities at the cost of environment. This subject has been introduced in the Diploma Programme to bring about awareness towards the environmental purity amongst the students.

2. TEACHING AND EXAMINATION SCHEME

Course Code & Course Title	Periods/ Week (In Hours)			Total Credits	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
GN203	**L**	**T**	**P**	**C**	**TH**	**TM**	**TW**	**PR/OR**	**100**
Environmental Studies	3	-	-	3	75	25	-	-	

Minimum passing %: Theory 40% ***Duration of Theory Paper: 3 Hrs.***

3. DETAILED COURSE CONTENT

Unit 1 Multidisciplinary Nature Of Environmental Studies.

Definition, scope and importance. Need for public awareness.

Unit 2 Natural Resources

Renewable and nonrenewable resources. Natural resources and associated problems.

- Forest resources: Use and overexploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people.
- Water resources: Use and over-utilization of surface and ground water, floods, droughts, conflicts over water, dams- benefits and problems.
- Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources. Case studies.
- Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer & pesticide problems, water logging, salinity, case studies.

- Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources, case studies.
- Land resources: Land as a source, land degradation, man induced land slides, soil erosion and desertification.

Role of an individual in conservation natural resources. Equitable use of resources for sustainable life styles.

Unit 3 Ecosystems.

Concept of an ecosystem. Structure and function of an ecosystem. Producers, Consumers and Decomposers. Energy flow in the ecosystem. Ecological succession. Food chains. Food webs and ecological pyramids. Introduction, types, characteristic features, structure and function of following ecosystems: (a) Forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) Aquatic ecosystems (Ponds, streams, lakes, rivers, oceans, and estuaries).

Unit 4. Biodiversity And Its Conservation.

Introduction – Definition: genetic, species and ecosystem diversity.

Biogeographical classification of India. Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values. Biodiversity at global, national and local levels. India as a mega-diversity nation. Hot spots of biodiversity. Threats to biodiversity: habitat loss, poaching of wild life, man-wild life conflicts. Endangered and endemic species of India. Conservation of biodiversity: In-situ and ex-situ conservation of biodiversity.

Unit 5. Environmental Pollution.

Definition. Causes, effects and control measures of: Air pollution, water pollution, soil pollution, marine pollution, noise pollution, Thermal pollution, Nuclear hazards. Solid waste management: Causes, effects and control measures of urban and industrial wastes. Role of individual in prevention of pollution. Pollution case studies. Disaster management: flood, earthquakes, cyclone and landslides.

Unit 6. Social Issues And The Environment.

From unsustainable to sustainable development. Urban problems related to energy. Water conservation rainwater harvesting, watershed management. Resettlement and rehabilitation of people; its problems and concerns; case studies. Environmental ethics: Issues and possible solutions. Climatic change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust; case studies. Wasteland reclamation. Consumerism and waste products. Environmental protection act. Air (Prevention and control of pollution) Act. Water (Prevention and control of pollution) Act. Wildlife protection Act. Forest conservation Act. Issues involved in enforcement of environmental legislation. Public awareness.

Unit 7. Human Population And The Environment. Population growth, variation amongst nations. Population explosion – Family welfare programme. Environment and human health. Human rights. Value education. HIV / AIDS. Women and child welfare. Role of Information technology in environment and human health. Case studies.
Unit 8. Field Work. Visit local area to document environment assets – river / forest / grassland / hill / mountain. Visit to a local polluted site – urban / rural / industrial / agricultural. Study of common plants, insects, birds. Study of simple ecosystems – ponds, river, hill slopes, etc. (field work equal to 6 lecture hours).

4. SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)

Unit No.	Topic	Teaching Hours	Marks
1)	Multidisciplinary Nature Of Environmental Studies.	01	03
2)	Natural Resources.	10	12
3)	Ecosystems.	06	08
4)	Biodiversity And Its Conservation.	06	09
5)	Environmental Pollution.	08	12
6)	Social Issues And The Environment.	07	12
7)	Human Population And The Environment.	04	09
8)	Field Work.	06	10
		48	75

5. MANDATORY ACTIVITIES

In addition to the class room instruction, visits should be arranged in any 2 of the following areas:

1. Visit to NIO or Science Centre.
2. Visit to Selaulim/ Anjunem Dam.
3. Visit to study ecosystem (Pond, Stream, River, and Forest).
4. Visit to show Hill cuttings, mining areas.
5. Visit to show Rain water harvesting project / Vermicomposting plant / Watershed management project. (Krishi Vigyan Kendra – Old Goa)
6. Visit to water treatment/ waste water treatment plant.

6. SUGGESTED VIDEOS

In addition to the class room instruction, video films on environment may be shown.

7. SUGGESTED LEARNING RESOURCES

S.No.	Author	Title of Books	Publication
1	Erach Bharucha	Textbook of Environmental Studies for Undergraduate courses	University Press
2	P. Meenakshi	Elements of Environmental Science and Engineering	Prentice Hall of India (PHI)
3	S. Deswal & A. Deswal	A Basic Course in Environmental Studies.	Dhanpat Rai & Co.
4	Pandya and Camy	Environmental Engineering	Tata McGraw Hill
5	Asthana D.K. and Asthana Meera	Environmental Problems and Solutions.	S. Chand & Co
6	Centre for Environmental education	Video Film	Thaltej Tekra, Ahme
7	Dr. S.K. Dhameja	Environmental Studies	

GN 205 ENGINEERING MATERIALS

1. RATIONALE:-

Adequate knowledge of different types of engineering materials, their properties & applications are very essential for the engineers. This course content is designed to provide basic insight knowledge regarding engineering material and their applications which will be useful for the students to learn subjects of higher semesters. The range of materials available for engineering applications is quite vast, hence only the basic groups of ferrous non-ferrous, non-ferrous & other engineering materials with their general properties and uses have been stressed upon.

2. TEACHING AND EXAMINATION SCHEME:

Course Code & Course Title	Periods/ Week (In Hours)			Total Credits	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
G-205	**L**	**T**	**P**	**C**	**TH**	**TM**	**TW**	**PR/OR**	
Engineering Materials	4	-	-	4	75	25	-	-	**100**

Minimum passing % : Theory 40% *Duration of Theory Paper: 3 Hrs.*

Legends:

L*-Lecture;* ***T*** *- Tutorial;* ***P*** *- Practical;* ***C****- Credit;* ***TH****- End Semester Theory;* ***TM*** *– Test Marks:*

PR/OR *- End Semester Practical / Oral Examinations;* ***TW-*** *Term Work*

3. COURSE CONTENTS

Unit 1 Introduction to Engineering Materials

Classification of Materials

- Metal, Non-metal
- Ferrous Metal & Non-ferrous Metals.

Differences between Metals & non-metals.

Properties of Materials.

- Physical properties – Melting point, freezing point, boiling point, Density, Linear co-efficient of expansion, Thermal conductivity, Electrical resistivity.
- Mechanical properties – Strength, Elasticity, Plasticity ductility,

Malleability, Toughness, Brittleness, Hardness, fatigue, creep.

- Electrical properties – Resistivity, conductivity, Temperature coeff. of resistance, dielectric strength, Thermo electricity, super conductivity.
- Magnetic properties – permeability, coercive force, magnetic stresses.
- Chemical properties - Corrosion resistance, chemical composition, acidity, alkalinity.

Unit 2 Ferrous & Non-Ferrous Metals & its Alloys

- **Ferrous alloys.**
  - Low carbon steel, medium carbon steel, High carbon steel, their carbon percentage, properties & uses.
  - Cast iron – Grey cast iron, white cast iron, spheroidal grey cast iron, their properties & uses.
  - Alloy steels.
    - Constituents of alloy steels such as phosphorous sulphur, Silicon, Manganese and their effect on properties of materials.
    - Stainless steel, chromium – Nickel steel, Nickel-chromium-molybdenum steel, Nitriding steel, Manganese steel, its properties & uses.
  - Tool steel – composition, HSS, High carbon steel, properties & uses.
- **Non-ferrous Metals & alloys**
  - Aluminium – Properties & uses.
  - Aluminium alloys – constituents of alloy & their effect on properties of metal
  - Properties & uses of Duralumin, Y-alloy, Al-si alloy, Al-Zn-Mg alloys.
  - Copper – Properties & uses.
  - Copper alloys – Constituents of alloy & their effect on properties of metal.
  - Properties & uses of Copper – Zinc alloys such as Muntz metal, manganese bronze, copper-Tin alloys such as Bronze, copper aluminium alloys such as aluminium bronzes.
  - Properties & uses of lead & its alloys.

Unit 3 Non – Metallic materials

- Refractory
- Desirable properties.
- Difference between acid, basic & neutral refractories.
- Properties & uses of Fire clay refractory, silica refractory.
- Plastic
- Classification table only.
- Properties & uses of Thermosetting & Thermoplastic.
- Natural & Synthetic abrasive materials.
- Introduction, Properties & uses.
- Rubber
- Properties & uses of natural, neoprene, synthetic & butyl rubber.

- Vulcanization process.
  - Glass
- Properties & uses of soda glass, Borosilicate glass, fibre glass.
- Glass wool – composition, properties & uses.

  - Introduction to composite materials.Classification diagram only.

Unit 4 **Conductor, Semi Conductor, Insulating and Magnetic Materials.**

- Classification of Materials as conductor, Semiconductor and Insulating materials.
- Conductor Materials.
  - High conductivity materials
    - Copper, Aluminium, Carbon, Silver, Lead, Brass, Bronz, Tungsten & Gold.
    - Their properties as conducting materials and applications.
  - High resistivity materials
    - hichrome, constantan, manganin
    - Their applications
- Insulating materials
  - Introduction
  - Characteristics of Good Insulating materials
  - Solid Insulating materials
    - Wood, paper, rubber, mica, glass tibre, porcelain, varnish, PVC, Resins.
  - Their characteristics as insulating materials and applications.
  - Liquid insulating materials
  - Mineral oil, its properties as insulating material and applications.
  - Gaseous insulating materials like air, Nitrogen, Sulphur hexafloride & their applications.
- Semiconductor Materials.
  - Silicon & Germanium. Their specifications as semiconductor material and uses
- Magnetic Materials.

  Classification as:
  - Dia Magnetic
  - Para Magnetic
  - Ferromagnetic
  - Non magnetic

List of these materials and their applications.

Unit 5 Construction Materials

- Building Stones : Classification of rocks, Characteristics of good building stones, common building stones & their uses.
- Cement: Chemical composition of port land cement, outline of manufacturing process, types of cements, uses.
- Bricks: Bricks – Constituents, properties, classification, special bricks – refractory and flyash bricks; uses.
- Other materials:
  - Lime – Sources. Properties, uses.
  - Clay – Different building products from clay like tiles, pipes etc.
  - Timber – Common varieties of timber, uses wood products, veneer, plywood, etc.
  - Sand – Sources: rivers, crushed aggregates, characteristics uses.

4. SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)

Unit No.	Topic	Teaching Hours/ Semester	Marks
1	Introduction to Engineering Materials	**04**	**09**
2	Ferrous & Non-Ferrous Metals & its Alloys	**16**	**18**
3	Non – Metallic materials	**12**	**12**
4	Conductor, Semi Conductor, Insulating and Magnetic Materials.	**16**	**18**
5	Construction Materials	**16**	**18**
		64	**75**

Semester :-III

Course code	Name of Course	TEACHING SCHEME				EXAMINATION SCHEME				Total marks
		L	T	P	C	Theory marks		Practical marks		
						TH	TM	PR/OR	TW	
FE301	Welding Technology-I	4	-	4	8	75	25	25	50	175
FE302	Fabrication Drawing	2	-	4	6	75	25	--	50	150
FE303	Fabrication Process-I	3	--	2	5	75	25	--	25	125
FE304	Electrical Engg Practice	-	-	2	2	-	-	50(P)	50	100
CS307	Elements of Mechancial Engg	3	-	1	4	75	25	--	25	125
CS301	Engineering Mechanics	3	1	2	6	75	25	--	50	150
	Total	15	1	15	31	375	125	75	250	825

FE 301 WELDING TECHNOLOGY-I

Rationale: The Welding Technology has given a fillip to the fabrication industry. Hence, the study of Welding Technology is very much essential. The topics are divided over two courses: Welding technology-I covers the advantages of welding as a fabrication process, the safety aspects in gas and arc welding equipment, processes and techniques. Welding of ferrous and non-ferrous metals in various positions, manual metal arc welding, equipment, processes and techniques in various positions. Soldering, brazing and allied welding processes have also been included.

TEACHING AND EXAMINATION SCHEME

Course Code & Course Title	Period/weeks (in Hours)			Total Credits	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
	L	T	P	C	TH	TM	TW	PR/OR	175
Welding Technology-I	4	-	4	8	75	25	50	25	

COURSE CONTENTS	Hrs	Mks
1. WELDING – A FABRICATION PROCESS Introduction. Historical background. Classification of welding processes. Commonly welded base metals. Advantages of welding as a means of fabrication. Disadvantages. Practical application of welding.	02	03
2. TERMINOLOGY Terms used in welding: Base Metals or parent metals, weld metal, molten pool or weld puddle or molten puddle, heat affected zone, fusion zone reinforcement, penetration, weld face, weld root, weld toes, edge preparation, root gap, root face, bevel angle, included angle, weaving, electrode angles, speed of welding, run or pass, flux, slag, heat input, distortion, etc. Types of welded joints and their symbols. Welding positions, weld slope and weld rotation, welder qualification based on welding position. Types of edge preparations, and its need. Back gouging, filling and its need.	05	06
3. GAS WELDING Definition. Oxy-acetylene welding:- Gas welding equipment: Oxygen gas Cylinder, acetylene gas cylinder, acetylene gas Generator (calcium carbide to water), anti-flash back device or flash back arrester, manifolding system for gas welding: advantages of using manifolds, oxygen and acetylene pressure regulator: single stage regulator, two-stage regulator, difference between oxygen and acetylene pressure regulators. Hose pipes, hose clamps (clips) and hose couplers, welding torch or blowpipe: low pressure welding torch, high pressure welding torch, welding nozzles or tips, gas welding trolleys. Principle of operation- Lighting the torch, flame adjustment, types of welding flame, chemistry of oxy-acetylene flame, to extinguish the flame and stop welding. Gas welding techniques: Base metal preparation, leftward techniques, rightward technique, comparisons of welding techniques. Welding filler metal rods and fluxes. Advantages, disadvantage and	15	18

applications of gas welding. Weld defects and rectification. Other oxy-fuel gas welding: oxy-hydrogen, oxy-propane, oxy-butane, oxy-natural gas, air-acetylene welding (Principle of operation and applications).
Safety recommendations for gas welding: Introduction. Safety recommendation for installation and operation of gas welding and cutting equipment. Gas cylinders. Manifolding of gas cylinder. Torches and tips. Pressure regulators. Hose or gas tubing. Other general precautions.

4. ARC WELDING 18 22

Definition of arc-welding. Physics of Welding: Welding Arc- Definition, methods of arc initiation, arc structure and mechanism, cathode drop zone, arc plasma column, anode drop zone. Arc characteristics- volt-amphere characteristic, volt-arc length characteristics. Arc Blow- factors affecting arc blow, type of arc blow, mechanism of arc blow, effects of arc blow, remedies of arc blow.
Metal transfer- Introduction, types of metal transfer, free flight transfer, short circuiting or dip transfer, forces affecting metal transfer, effects of arc current and arc voltage on drop transfer rate. Arc welding equipment: Introduction. Arc welding power sources- D.C. power sources- motor generators sets, A.C-D.C. rectifiers, Invertor based power sources, engine driven generator, polarity and its effects. A.C. power sources- welding transformers. Characteristics of power sources- Constant current or drooping characteristics, constant voltage or flat characteristics, rising voltage characteristics, advantages and disadvantages of each type of power sources, selection factors for power source. Other accessories required for arc welding: welding cables, lugs and cable connectors, ground connection, electrode holder, chipping hammer and wire brush, hand shield and helmets, protective clothing. Welding electrodes: Types of welding electrodes- Non-consumable electrodes, Consumable electrode- Bare electrode, flux cored electrode, flux covered electrode- Details of types and classification, electrode coatings and their functioning, deposition efficiency of electrode. Manufacture of electrodes, selection of electrode, care, storage and reconditioning of covered electrode in general. Care, storage and special precautions for low hydrogen electrodes. Classification and coding of mild steel and low alloy steel electrodes- American (AWS-ASTM) system, British (BS) system, Bureau of Indian Standard (BIS) system. Welding of round bars and pipes. Weld bead geometry. Weld defects: types of defects, their causes and remedies. Cracks, distortion, incomplete penetration, slag inclusions, Porosity and bore holes, poor fusion, poor weld bead appearance, spatter, undercutting, overlapping, defective weld geometry. Safety recommendations for arc welding. Safety recommendations for installation and operation of arc welding and cutting equipment. Arc welding machines, electrode holder. Explosion, fire and other hazards- Explosion, fire hazards, over heating hazards. Protection of welders- Protection from welding rays, protection of welders from sparks, spatters and welding fumes. Ventilation and health protection. Welding and heat treatment- Pre heating, inter pass heating, post heating & post weld heat treatment.

5.BRAZING & SOLDERING 10 10

Definition, principle of operation, brazing procedure, surface cleaning, bazing

joint design. Base metals brazed- aluminium and its alloys, magnesium and its alloys, copper and its alloy, low carbon and alloy steels, stainless and heat resisting steels, cast iron, nickel and high nickel alloys. Brazing alloys (filler metal)- aluminium- silicon, magnesium, copper and copper zinc, copper, phosphorus, gold ,nickel, silver brazing alloy, selection of filler material. Advantages and disadvantages of brazing. Brazing processes (advantages and limitations of each process)- Torch brazing, furnance brazing, vacuum brazing, induction brazing, dip brazing, resistance brazing, carbon arc brazing. Silver brazing- Introduction, brazing alloys, flux, methods, joint clearance, advantages and limitations, applications.
Difference between brazing and braze welding.
Soldering: Introduction, definition, principles of good soldering process, soldering joint design. Soldering alloys, Cleaning the base metal surface- Mechanically, Chemically. Limitation of soldering, comparison of soldering, brazing and welding.

6. HARD FACING, STELLITING AND METAL SPRAYING	06	06

Definition and concept of surfacing , Hardfacing, Objectives of hard facing
Principles of operation, steps involved. Base metals that can be surfaced.
Stelliting- introduction, stelliting of steel, stelliting of cast iron, heat treatment for depositing stellite.
Metal spraying or metalizing- introduction, definition, methods of metal spraying, flame spraying process, wire spraying process, powder spraying process, electric arc spraying , advantages and disadvantages of sprayed coating, applications of sprayed coatings.

7. WELDING OF METALS AND ALLOYS	08	10

Welding of carbon steel, mild steel, low, medium and high carbon steels. Welding of alloy steel. Welding of stainless steel. Welding of cast irons. Welding of Aluminum & its alloys. Welding of copper and its alloys. Welding of nickel and its alloys. Welding of dissimilar metals.

Total	64	75

Term work

A) Manual Metal Arc Welding MMAW- Study of Arc Welding equipment. Jobs in Flat position: Weld Pad building, square butt joint, V-butt joint, lap joint, Tee joint, corner joint. Pipe to plate (with rotation). Pipe to pipe (with rotation). Jobs in Vertical position: V-Butt joint, lap joint, Tee joint, corner joint. Jobs in vertical- horizontal position: Tee joint, pipe to plate.
B) Oxy-Acetylene flame welding. Study of Oxy- Acetylene flame welding equipment. Practices to open the set, adjust pressures. Lighting the torch, adjusting the flame, putting off the torch and closing the set. Jobs in flat position: Fusion runs, Butt joints without filler, Running beads, Butt joint with filler.
C) Composite Job.

Notes:- The term –work shall consist of the above mentioned practical jobs and a journal in which the equipments used, procedure adopted, inspection of the job done etc. should be systematically recorded. Practical examination will be of 3 hours duration on a composite job involving arc and flame welding in flat, vertical and vertical –horizontal position.

REFERENCE BOOKS

Latest edition of recommended reference books are to be made available in the library.

1. A Text- Book of Welding Technology by Dr. O.P. Khanna Dhanpat Rai & Sons, Delhi.
2. The Science and Practice of Welding, vol. II, The practice of Welding by A.C. Davies Cambridge University Press.
3. Metals Handbook, American Society for Metals (ASM), volume 6- Welding and Brazing.
4. Welding Skills and Technology by Dove Smith Gregg Division Mc Graw Hill Book Company.
5. Modern welding by A.D. Althouse, C.H. Turnquist and W.A. Bowditch The Goodheart-Willeox Co.
6. Welding and Welding technology by Richard, L. Little, Tata McGraw hill Publishing Company Ltd.
7. AWS Code book (Concise edition)
8. Welding Journals (Indian Institute of Welding and American Welding Society)
9. Welding Handbook Vol. I-V American Welding Society 550, N.W. Le Jeune Road P.O. Box 351040.

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FE 302 FABRICATION DRAWING

Rationale:- This final course in drawing is designed to suit the need of fabrication engineering technicians. The pre-requisite for this course has already been dealt with the earlier course in drawing. The contents included in this course are based upon the needs, which emerged out from the job survey.

TEACHING AND EXAMINATION SCHEME

Course Code & Course Title	Period/weeks (in Hours)			Total Credits	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
	L	T	P	C	TH	TM	TW	PR/OR	
Fabrication Drawing	2	-	4	6	75	25	50	-	150

COURSE CONTENTS	Hrs	Mks
1.TERMINOLOGY Fabrication technology, fabrication drawing, design drawing, machine drawing, foundation or anchor bolt, bearing plate, column, beam, girder, cleats, splicing, bracing, lacing, fabrication or shop clearance, field or site or erection clearance, gauge line, bench mark, erection diagrams, edge clearance, driving clearance, etc.	4	04
2.STRUCTURAL ENGINNERS HAND BOOK [SP:6(1)] Designation and specification of rolled section (I- beams, channels, equal angles, unequal angles, bulb angles, tee bars, strips, sheets, flats, plates, round bars, square bars, hexagonal bars, etc.). Sketch of any one section of each rolled section with clear dimensioning. Determination of sectional and design parameters of a particular section. For I- beam, connection details.	4	06
3. CONVENTIONAL SYMBOLS FOR JOINTS Conventional symbols for rivet, bolts and riveted joints. Symbols for site and shop rivet and bolts. Edge distances for rivets as per IS 800. Gauge lines for angles channels I-beams, and other rolled sections. Rivets gauge distances in legs of angles. Rivet size and spacing as per IS 800. Different types of riveted joints. Determination and selection of rivet size. Sketch of riveted joints of known thickness of plates and dimensioning clearly.	4	06
4. WELD REPRESENTATION (AS PER IS:813) Introduction: Weld symbols, Position of symbols on drawing. Dimensioning of welds. Complementary indications. Practical examples.	4	09
5. FABRICATION DRAWINGS Preparation of Fabrication Drawing from a Design drawing of any simple truss (refer chapter 27 of reference book 2) with riveted, welded and welded/bolted joints. Drawing the orthographic views, isometric views and detailed drawing of each members from assembly pictorial sketch of any	6	20

simple support made up of rolled sections of welded joints only.

6.BILL OF MATERIALS	1	04
Preparing a bill of materials of small assembly drawings as of those in chapter 5 in tabular form. Marking and naming of different members: identical members, mirror image members, un-identical members. Essential column in the bill of materials: serial No., part name/no., description, major dimensions (length, breath, thickness), quantity, weight per part, total weight and gross weight.		
7.STRUCUTURAL DRAWING (SKETCHES ONLY)	4	10
Different column base connections (welded and riveted) , detailing of beams and columns. Column to beam connections. Beam to beam connections. Lacing systems. Different column splices. Different parts of roof truss. Different types of roof trusses. Typical ridge joint. Typical shoe joint. Form of plate girders. Typical section of crane girders. Components of plate girder (welded and riveted).Bearing and transverse stiffness in plate girders. Web splices in plate girders.		
8.PIPE LINE AND PIPE JOINTS	5	16
Introduction: Purpose of pipelines. Different pipe materials. Pipe manufacture. Specification of M.S pipes. Pipe joints: screwed pipe joints, flanged pipe joints. Welded flange. Screwed flange Forged flange. Welded pipe joint. Plain butt-welded. Butt-welded with backing ring. Bell and spigot pipe joints. Pipe bends, flexibility or ability to absorb expansion, expansion bends. Gland and stuffing box expansion joints. Copper corrugated expansion joint. Pipe loops. Need of expansion joints in pipelines. Pipe supports: Need of pipe support, different types of pipe supports: clamp type hanger, turn buckle hanger, U-bolt hanger, Plate hanger. Roller support. Screw jack support. Different types of pipe fitting and valves: Elbow, Tee, Union, Reducers, Laterals, Globe valve, Gate valve, Stopcock, Plug or cap, coupling. Different types of pipeline drawings- single line, double line, their difference Symbol of pipe fitting and valve in screwed, flanged, bell and spigot, welded and soldered joints in single line. Isometric view, Orthographic view and developed view. Drawing isometric view from Plan of pipelines, knowing the elevation levels of pipes in single line only.		
Total	32	75

Note:- Use of B.I.S: 800 codes and I.S.I Structural engineers Handbook (SP6(1)) is permitted in examination. Maximum time of each test :- 1 hr, maximum time of theory examination :- 4 hrs.

Term work

Fabrication Drawing Sheets (2 sheets min.) based on topic 5, 6 and 8

Sketchbook (minimum 25 plates) based on topics 2,3,4,7 and 8.

REFERENCE BOOKS

1. B.I.S. Codes 800,813,696,806,801
2. Engg. Drawing and geometry by Hoelscher & Springer (John Willy & Sons Inc.) Chp.27,28, 29
3. Structural Engineers Handbook by Milo S. ketchum Mc Graw Hill Book Co.
4. Engineering Drawing by Thomas E. French and Charles J. Vierek
5. Fundamental of Engg. Drawing by Warran J. Luzadder, Prentice Hall of India Chp.18,19,22
6. I.S.I. Structural Engg. Handbook (SP:6(1)) Students are strongly advised to own his handbook.

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FE 303 FABRICATION PROCESS – I

RATIONALE:- The technician engaged in Fabrication and Erection Industry is required to use a variety of measuring instruments during the manufacture and inspection of jobs. He must also be well versed in the skill of marking, of different types of sections and ensure proper alignment during the assembly and erection. He should possess the knowledge of metal sawing and flame cutting processes, which the material has to undergo before further processing. The curriculum is designed to provide the knowledge and skill required in handling the instruments, besides developing practical skill in marking, metal sawing and flame cutting. The course is a pre- requisite for further practice of fabrication.

TEACHING AND EXAMINATION SCHEME

Course Code & Course Title	Period/weeks (in Hours)			Total Credits	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
	L	T	P	C	TH	TM	TW	PR/OR	
Fabrication process - I	3	-	2	5	75	25	25	-	125

COURSE CONTENTS	Hrs	Mks
1. MEASUREMNET	20	30

Introduction: Physical measurements, precision and accuracy, sources of errors, calibration and classification of measurements. Standard of measurement: Introduction to standards, line standards, end standards, wavelength standards, angular standards. Direct eye measurements. Linear Measurement: Engineer's rule, steel tape, use of steel rule and tape, possible error with eye measurement. Verneir caliper: Principle of Verneir Caliper, application of Verneir caliper, precaution in usage. Verneir height gauge: Description , use of height gauge, precaution in usage. Verneir depth gauge. Micrometer (Internal and External) :

Principle of micrometer, use of micrometer, precaution in usage. Raduis gauges. Feeler gauges. Wire and thickness gauge. Pitch gauge. Angular measurement: Engineer's Protractor, Verneir protractor, Universal Bevel protractor, use of spirit level for angular measurement. Datum measurement: Vertical Datum: Plumb line, use of plumb line, Plumb board, use of Plumb board. Horizontal datum: Spirit level, water line, use of spirit level, use of water line. Alignment testing: Use of tensioned wire, alignment telescope, surveyor's level. Geometric shape: Introduction, Strainghtness testing: straight edge method, spirit level method. Flatness testing: Comparison with flat surface, use of Ink on surface plate, use of spirit level. Squareness testing: Engineer's square, block square, Method of testing. Roundness measurement: Fixture and dial indicator method. Dial indicator or dial gauges- Introduction, types of dial indicators, requirement of good dial indicator. Advantage of good dial indicator. Care of dial indicator. Bore gauge: Construction and use. Limit and fits: Introduction, Basic dimension, different ways of expressing tolerance, definitions: nominal size, zero line, actual size, limits, tolerance, fit and types of fits. ISO system of designation of limits and fits. Limit gauges: Plain plug gauges, snap gauges and contour gauges.

2. MARKING Tools used in marking: Scriber: use of scriber, possible error when using scriber. Scribing block: Parts of scribing block, use of scribing block. Scratch gauge: Construction, use of scratch gauge. The Bevel: construction, use of bevel. Dividers and compasses: various sizes of dividers, used of dividers. Beam trammels: Construction, use of beam trammels. Pencils. Ink markers. Angle plates. 'Vee' Block. Pipe square. Box angle plate, Adjustable swivel angle block, Nipple punch, Dot punch. Marking method for large size plates. Methods of marking out bolt holes for flanges. Data for marking out pipes flanges, constant for bolt hole location (flanges), procedure for marking. Use of chalk line for marking long straight line. The need of templates. Materials used for template. Information given on templates. Use of templates. Templates as a means of checking. Protection and storage of templates and tools. Templates for setting out sheet metal fabrication. Box templates. Steel templates (ordinary and bushed). Marking of hole in angle sections. Marking a hole in channel sections. Marking of holes in "Tee" sections. Marking of holes in column or beams. Comparison of the method of direct marking and use of templates.	16	24
3. METAL SAWING Brief description of sawing and abrasive cutting machines: reciprocating power hacksaw, circular metal saw, table sawing machine, band sawing machine, and abrasive cutting machine. Practical examples of use. Advantages and disadvantages of each method. Safety precaution during operation.	06	09
4. INTRODUTION TO FLAME CUTTING Basic principle of flame cutting. Flame cutting equipment: Cutting oxygen pressure, fuel gas used- Propane, natural gas, acetylene, LPG. Cutting torch details for each type of fuel gas. Nozzle mix cutting torch. Flame adjustment: Procedure for lighting the cutting torch, adjustment of flame, procedure to extinguish the flame. Factors influencing the quality of cut. Comparison of flame cutting with shearing.	06	12
Total	48	75

Term work

Job	Prcs.
1. Study of various measuring instruments mentioned in the syllabus	2
2. Measurement of actual parts with measuring instruments studied in Job1	1
3. Study of various marking tools mentioned in the syllabus	2
4. Study of Power hacksaw machine, marking to exact length a given rolled section and cutting it on the power saw.	2
5. Marking of holes on job 4 to exact given dimensions and drilling the holes.	1

6. Marking a wooden template of a given gusset plate sketch and marking the same on the steel plate.	1
7. Study of oxy- acetylene cutting set.	1
8. Exercise of opening the Flame cutting set, lighting the cutting torch, adjusting the Flame, putting off the torch, and closing the set.	1
9. Practice of flame cutting on steel scrap.	1
10. cutting the marked gusset plate in Job6 with flame cutting and drilling the holes	1
11. One job involving marking, hand-sawing, filling, drilling and gas cutting, with inspection report.	3
Total	16

Notes :- The student should maintain a Journal for each job done, in which, the procedure adopted and whatever learnt during the practical classes should be clearly and systematically recorded. Undue weightage for a particular sub-topic should be avoided.

REFERENCE BOOKS

1. Basic Fabrication and Welding Engineer by Smith F.J.M. Longman
2. Technician Fabrication and Welding by Cooper K.J. Greenwood (Cassell series)
3. Basic Welding and Fabrication by Kenyon W. Pitman
4. Workshop Technology by Hajara Choudhary S.K. (Asia)
5. Technician Manufacturing Technology by Shotbolt C.R. Cassell
6. Engineering Metrology by R. K. Jain
7. Modern Welding by A.D. Althouse, C.M. Twrnquist, and W.A. Bowditch
8. Welding Skills and Technology by Dave Smith.

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(FE304) ELECTRICAL ENGINEERING PRACTICE

RATIONALE: This course will enable the students to inculcate practical skills in the identification of power supply systems, their conductors, use of switching and protective devices such as fuses, circuit breakers, as well as use of welding equipments and identification of 1Ø and 3Ø induction motors, their methods of starting and reversal of direction of rotation. Also different types of lamps will be identified along with their characteristics.

TEACHING AND EXAMINATION SCHEME

Course Code & Course Title	Period/weeks (in Hours)			Total Credits	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
	L	T	P	C	TH	TM	TW	PR	
Electrical Engineering Practice	-	-	2	2	-	-	50	50	100

TERM WORK

The term work shall consist of conducting the following experiments in the laboratory and completion of assignments:-

Sr. No.	Description
1.	Study of Symbols of various Electrical Components.
2.	Identification of Switches, Sockets, Switch Fuse and Fuse Switch Units, MCB, MCCB, ELCB and its practical applications.
3.	Fuse and replacement of appropriate Fuse Wire in Switch Unit and HRC Fuse in Fuse Switch Unit.
4.	Study of D.C. Welding Generator with respect to Construction, Working, External Characteristics and Current Controllers used.
5.	Identification of A.C. Supply System, as well as conductors used in each System a) 1Ø, 2 wire, b) 1Ø, 3 wire, c) 3Ø, 3 wire, d) 3Ø, 4 wire, e) 3Ø, 5 wire
6.	Testing of Domestic wiring Installation: a) Insulation Test between conductors. b) Insulation Test between Conductor and Earth. c) Continuity Test. e) Polarity Test.

7.	i)Wiring Diagram for one fan, one light load and 3-pin socket outlet.
	ii)Wiring Diagram for Staircase Wiring.
8.	Reading of Domestic and Industrial wiring system.
9.	Estimation of Energy Bill for a given Load and its Operation schedule.
10.	Connection of 1Ø Transformer and measurement of Input and Output Quantities (V, I and W).
11.	Study of Welding Transformers with respect to: a) Construction, b) Method of cooling, c) Current Controllers Used.
12 .	Starting a 1Ø and 3Ø induction Motor. Study of methods to reverse the direction of rotation.
13.	Study of various Lamps used for Lighting such as Incandescent Lamp, Fluorescent Lamps, Mercury Vapor Lamp (HPMV) and Sodium Vapor Lamps (HPSV) w.r.t. their Characteristics such as: a)Operating Voltage, b) Starting Time, c) Colors rendering effect f) Effect of Variation in Voltage on Lumen output of Lamp, LED Lamps.
14.	Study of Bimetallic Relay for overload protection.
15.	Measurement of Power Factor for a given Installation, calculation and method to improve it.

NOTE:- The theory part relevant to the Practical shall be covered before the Practical is conducted in the Laboratory itself.

Student has to maintain a journal, in which he has to neatly record, what he has learnt while performing the experiments, systematically. Term end Practical Examination shall be conducted of 50 marks.

REFERENCE BOOKS.

1. Electrical Engg. Hand Book by S. L. Bhatia.
2. Electrical Wiring and Its Estimation, by Aurora.

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CS307 ELEMENTS OF MECHANICAL ENGINEERING

1. RATIONALE:-

In this modern scientific era, the field of engineering and technology is continuously expanding, with many newer branches of engineering being added day by day. Under present circumstances it is highly essential for an engineer and technician to acquire basic knowledge of some other relevant engineering fields, along with his own discipline of study. Also the technician carrying out plant maintenance requires basic knowledge of functions of mechanical elements & machines from operational and safety point of view. Hence this subject is being introduced in the curricula as an interdisciplinary subject to provide basic knowledge of mechanical engineering to the students of other engineering disciplines.

2. TEACHING AND EXAMINATION SCHEME

Course Code & Course Title	**Periods/ Week (In Hours)**			**Total Credits**	**Examination Scheme**				
					Theory Marks		**Practical Marks**		**Total Marks**
CS307 Elements of Mechanical Engineering	**L**	**T**	**P**	**C**	**TH**	**TM**	**TW**	**PR/OR**	**125**
	3		**1**	**4**	**75**	**25**	**25**	**-**	

Minimum passing % : Theory 40% *Duration of Theory Paper: 3 Hrs.*

Legends:

L*-Lecture;* ***T*** *- Tutorial;* ***P*** *- Practical;* ***C****- Credit;* ***TH****- End Semester Theory;* ***TM*** *– Test Marks:*

PR/OR *- End Semester Practical / Oral Examinations;* ***TW-*** *Term Work*

3. DETAILED COURSE CONTENT

Unit 1 Mechanical Power Transmission (*No mathematical treatment)*

Introduction. Belt drives – classification & applications, technical specifications (power & cross sectional area). Chain drives – Types of chains and their applications. Gear drives – classification and applications, gear trains (simple & compound only) and their speed ratio. Couplings – rigid coupling (marine type only), flexible coupling (bush pin type only), fluid coupling. Bearings – Definition & function of bearings, rolling and sliding contact bearings (their functions and applications), bearing specification (4 digit bearing number).

Unit 2 Internal Combustion (I.C.) Engines (*No mathematical treatment)*

Introduction, classification & basic engine components. Construction and working of 4 stroke and 2 stroke engines (petrol & diesel). Difference between petrol and diesel engines. Difference between 2stroke and 4 stroke engines. Technical specification of I.C. engines –

Stroke volume, speed (rpm) & torque, power. Criteria for selection of I.C. Engines.

Unit 3 Thermal Engineering

Introduction. Basic components of a thermal power station and their function

(Condenser, Turbine, Boiler).

Boiler – Introduction, function, classification (water tube, fire tube), Construction and working of Babcock & Wilcox boiler and Cochran boiler. Comparison between fire tube and water tube boiler. Boiler mountings and accessories like- Safety valve, water level indicator, Economiser and superheater. Awareness to Indian Boiler Regulations i.e. IBR (Brief introduction only).

Unit 4 Refrigeration & Air conditioning (*No mathematical treatment)*

Introduction. unit of refrigeration (Ton), Working and operation of simple vapour compression system (p-h & t-s diagrams to be excluded).
Air Conditioning- definition, working of Window and split Air conditioner, procedural steps in installation of Air conditioner.

Unit 5 Pumps (*No mathematical treatment)*

Introduction, working principle, classification. Centrifugal and reciprocating pump - construction & working. Common faults in working of pump and troubleshooting. Technical specifications - power, discharge, head.

Unit 6 Maintenance Engineering (*No mathematical treatment)*

Definition, types -preventive, breakdown and predictive maintenance. Necessity of lubrication. Common types of lubricants. Methods of lubrication – wick/drip type, grease gun, grease cup. Importance of lubrication schedule. Maintenance tools and their functions (no construction & working) – bearing puller, spanners (open end & ring type), screw jack, gauges, screw driver, torque wrench, allen key, chain pulley block, tripod.

Note to paper setters:-

Internal details of subcomponents of the following should not be asked-

i) I. C. Engine systems.

ii) Pumps.

iii) Turbines and condensers

4. SUGGESTED SPECIFICATION TABLE WITH MARKS & HOURS (Theory)

Unit No	Name of the Unit	Hours	Marks
1	**Mechanical Power Transmission**	8	15
2	**Internal Combustion (I.C.) Engines**	12	18
3	**Thermal Engineering**	8	12
4	**Refrigeration & Air Conditioning**	8	12
5	**Pumps**	06	09
6	**Maintenance Engineering**	06	09
	TOTAL	**48**	**75**

5. SUGGESTED LIST OF EXPERIMENTS

Sr. No	UNIT No.	LIST OF EXPERIMENTS
1	1	Study of different types of gears.
2	1	Removal and mounting of belt. Checking tension in the belt.
3	1	Demonstration of mounting and removal of ball/roller bearing.
4	2	Study of petrol/diesel engine construction.
5	2	Study of petrol/diesel engine working.
6	3	Study of water tube and fire tube boiler (Babcock & Wilcox and Cochran).
7	4	Study of any one refrigeration Air conditioning equipment working on simple vapour compression system.
8	5	Study of centrifugal and reciprocating pumps.
9	6	Literature survey and seminar (A brief power point presentation of around 15 min on any topic relevant to mechanical engineering). It may be done individually or in groups depending on class strength. **OR** Field visit to maintenance work shop and detailed report on maintenance to be presented by students.

6. SUGGESTED LEARNING RESOURCES

Sr. No.	AUTHOR	TITLE	PUBLICATION & YEAR
1	R.K. Rajput	Elements of mechanical engineering	Laxmi pub.
2	A.A. Karad & K.B. Kale	Elements of mechanical engineering	Technical Pub., Pune.
3	R.K. Rajput	A text book of Hydraulic Machines	S. Chand
4	K.R. Gopalkrishna	A text book of elements of Mechanical Engineering.	Subhash pub., Bangalore
5	S.N. Bhattacharya	Installation, Servicing & Maintenance	S. Chand
6	H.P. Garg	Industrial Maintenance	S. Chand
7	V. K. Manglik	Elements of Mechanical Engineering	PHI

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(CS301) ENGINEERING MECHANICS

1. RATIONALE.

The focus of the course is to study rigid bodies, subjected to motion or equilibrium with the particular emphasis of engineering applications. This course plays a key role in engineering and is a pre- requisite for all design applications. Basic understanding of the concepts and principles involved in mechanics is essential. The concepts in Applied Mechanics form the base of all engineering disciplines. Applications of principles to engineering situations is emphasized in this course. Considering the level of student, concepts are difficult; hence classroom demonstration should be used to explain concepts and principles.

2.

Course Code & Course Title	Periods/ Week (In Hours)			Total Credits	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
CS301	L	T	P	C	TH	TM	PR /OR	TW	
Manufacturing Processes-I	3	1	2	6	75	25	-	50	150

Minimum passing % : Theory 40% and Practical 40% Duration of Theory Paper: 3Hrs

3. COMPETENCY TO BE DEVELOPED THROUGH THIS COURSE.

The course content should be taught and implemented with the aim to appreciate and apply the Principles and Laws of Engineering Mechanics in basic Engineering Design concepts.

4. DETAILED COURSE CONTENT

CH1. FORCE **09 Mrks** **05hr**

Definition & units of Force, Types of Forces, its Characteristics, Effect of Forces,

System of Forces, Resolution & Composition of Forces (Resolving along X & Y Axis only).

Relationship between Resultant & Equilibrant Force.

Application of Resolution to find Resultant of coplanar concurrent Force System, and Finding missing force when resultant is given.

CH2. MOMENTS **09Mrks** **04hrs**

Definition and units, Sign conventions (Take clockwise +ve, Anticlockwise -ve)

Definition & units of couple (clockwise +ve, Anticlockwise -ve)

Characteristics of couple, Varignon's Theorem,

Application of above to find Resultant in magnitude, direction and line of action in Coplanar Non- concurrent and parallel Force system.

CH.3 EQUILIBRIUM **18Mrks** **12hrs**

Concepts of Equilibrium,Conditions of Equilibrium for Two forces, Three forces, concurrent & non concurrent force system, Lami's Theorem and its application..

Concepts and drawing of Free Body Diagram involving not more than three bodies.

Definition of Beam, types of beams, types of Supports and types of loading.

Application of Equilibrium to beams (Beams with two supports at the ends, Beams with overhangs) with Concentrated loading, UDL, Partially UDL Loading only.

Applications of Equilibrium to determine the forces in the member of the perfect simple support and cantilever truss using method of Joints. Graphical method/ Maxwell diagram for determination of forces in the member of truss.

CH.4 FRICTION **09Mrks** **06hrs**

Definition, Coulombs Law of static friction, coefficient of friction, Angle of friction, Cone of friction, Angle of Repose

Application of Friction with a block on horizontal and inclined Plane , Ladder friction.

CH.5 KINETICS **12Mrks**
09hrs

D'Alemberts Principle and its Application

Simple problems related to Motion of Lift, Two connected bodies with a single string, suspended on horizontal and inclined planes.

CH.6 MOMENTUM, IMPACT, AND IMPULSE **06Mrks**
04Hrs

Definition and units of Momentum and Impulse

Definition of impulsive force

Law of Conservation of Momentum.

Simple problems related to Momentum and Impulse, impulsive force, Law of Conservation of Momentum

CH.7 WORK, POWER & ENERGY **12Mrks** **08Hrs**

Definition and units of Work, Power and Energy.

Forms of Energy – Kinetic and Potential Energy.

Principle of Conservation of Energy

Simple numerical problems to calculate Work, Power, Energy & conservation of Energy.

Total = 75 Mrks **48 Hrs**

Engineering Mechanics (Practicals)

Experiments:- (Minimum 06 experiments)

1. To Verify Polygonal Law of forces.

2. To Prove Lami's Theorem.

3. To find Co-efficient of Friction.(Any Two Surfaces)

4. To Determine Reactions in Beam Apparatus.

5. Four experiments on Lifting Machine to find M.A, V.R , Efficiency, and to obtain Law of Machine

Graphical Analysis: - 3 sheets (Half Imperial)

a) Determination of Resultant of Coplanar Concurrent Forces.

b) Determination of Resultant of Coplanar, Non-concurrent Forces and Parallel.

c) Analysis of Trusses (Simply supported and Cantilever) using Maxwell diagram.

Reference Books :-

1. Fundamental of Applied Mechanics – Dadhe, Jamdar, Walavaikar

2. Applied Mechanics – R.S. Khurmi

3. Engineering Mechanics – A.R. Basu

4. Applied Mechanics Vol-I – R.C. Patel & B.M. Patel

Semester :- IV

Course code	Name of Course	TEACHING SCHEME				EXAMINATION SCHEME				Total marks
		L	T	P	C	Theory marks		Practical marks		
						TH	TM	PR/OR	TW	
FE402	Fabrication Process-II	3	--	4	7	75	25	25	50	175
FE403	Welding Technology-II	4	--	4	8	75	25	50	50	200
FE404	Materials & Processes	4	--	--	4	75	25			100
CE402	Materials & Structures	4	--	2	6	75	25	--	25	125
CS305	Computer Aided Drafting	--	--	4	4	--	--	50	50	100
CS311	Elements of Civil Engg.	3	--	2	5	75	25	--	25	125
	Total	18	--	16	34	375	125	125	200	825

(FE402) FABRICATION PROCESS-II

Rationale: This course is a continuation of Fabrication Process-I. The course lays stress on straightening and cutting operations both manual and using machinery. Operations of drilling, milling, shaping and grinding are also included in this course as they also fall under the broad category of cutting or removal of the materials. The course is intended to bring the students nearest to the fabrication industrial situations, enabling him to develop an appreciation of the real life experiences, which he would encounter later in his day to day work.

TEACHING AND EXAMINATION SCHEME

Course Code & Course Title	Period/weeks (in Hours)			Total Credits	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
	L	T	P	C	TH	TM	TW	PR	
Fabrication Process-II	3	-	4	7	75	25	50	25	175

Content	Hrs	Mks
1. STRAIGHTENING OF STRUCTURAL MEMBERS Need, Methods of straightening: Mechanical straightening: Manual straightening: use of different tools & techniques, Machine Straightening-uses of presses. Straightening with heat: Principle, Heat triangles, Heat strips	2	5
2. STRAIGHT LINE SHEARING Principle of shearing: shearing angle, rake angles of blades, clearance between cutting edges. Straight-line cutting machines (brief description): Bench shearing machine, treadle guillotine machine, power guillotine machine. Setting of guillotine (demonstration), Operations on the guillotine (demonstration). Safety during operations.	4	6
3. ROTARY SHEARING MACHINE. Advantages of rotary shearing machines. Types of rotary shearing machines: Parallel Shaft machine, inclined shaft machine. Shearing essentials features.	3	4
4. NIBBLERS Portable NIBBLERS (brief Description and use), Shear type and Punch type.	2	4
5. CROPPING AND NOTCHING MACHINE. Meaning of Cropping and Notching. Necessity for notching in angle sections. Universal Steel Shearing Machine for cropping angles, Tee, round, square bars, punching holes and cutting, notches. Safety precautions in use.	3	6
6. CENTRE LATHE Introduction, Function of the lathe, parts of lathe, Lathe operations: straight turning, taper turning, Eccentric turning, chamfering, Thread cutting, Grooving, Facing, Knurling, Filing, Boring, Internal thread Cutting. Cutting speed, feed Dept of cut. Safety precautions.	4	8
7. DRILLING AND BORING MACHINES Introduction, portable drilling Machine, sensitive drilling Machine, Radial Drilling Machine, Work holding devices: T- bolt and clamps, Drilling Vise. Tool holding Devices: Drill chuck, Mourse standard Taper sleves, Drift. Drilling Machine Operations: Drilling, Reaming, Boring, Counterboring,	6	6

Countersinking, spot facing, Tapping, Lapping, Grinding, Trepanning. Boring Machines: Introduction, Brief description of Boring Machines: Horizontal, vertical, precision, and Jig boring machines.		
8. MILLING MACHINE Introduction, brief description of column and Knee type Milling Machine, Universal Milling Machine. Milling Machine operations: Plain Milling, Face milling, Side Milling, Form Milling, End Milling, Milling Key ways, grooves & slots, Gear cutting. Safety measures in milling.	4	6
9. SHAPING & PLANNING MACHINE Shaping Machine: Introduction, Working of Crank type Standard Shaper. Principal Parts, quick return mechanism, Adjusting the length of stroke, adjusting the position of stroke, Work holding devices: shaper Vises, Parallels, Hold downs, shaper operations. Planning Machine: Introduction, Planning Machine Parts, planer operations, shaper Versus Planner, Safety on Planner.	6	8
10.GRINDING MACHINES Introduction, Kind of Grinding: Rough & Precision grinding. Rough: Floor stand and bench grinders, Portable and flexible shaft grinders, swing frame grinders, abrasive belt grinders. Precision grinding: Surface grinding, Cylindrical grinding; Centre & Centreless. Wheel shapes and sizes. Safety precaution.	4	6
11.FLAME CUTTING- APPLICATIONS AND MACHINES Applications of flame cutting by hand. Techniques of cutting thick plates near edges. Techniques of cutting away from edge. Technique of cutting of round bar. Use of attachments in hand cutting to ensure steady rate and to cut along desired lines such as cutting along straight lines, small circles, large circles, and other shapes. Rivet removal. Removal of defective weld by gouging. Flame cutting machines (brief descriptions and use) Portable cutting machines with one or more cutting torches. Profile cutting machine. Template allowance.	4	8
13.SPECIAL CUTTING AND BEVELLING MACHINES Principle and Working of plasma arc cutting & Laser cutting of steel. C.N.C. steel profile cutting Machines (Brief Description) Portable sawing machines: rotary , reciprocating. Plate edge preparation machines (Bevellers). Pipe end bevelling machines.	6	8
Total	48	75

TERM WORK

JOBS.

Cutting a structural member of given length, straightening it, cutting notches at its ends and piercing slots and holes by hand flame cutting, drilling holes and grinding as per drawing.

One simple turning job involving operations like facing, stepping turning, taper turning and threading.

One shaping job involving straight and inclined shaping of a block.

One milling job involving plain and angle milling of 10mm thick plate piece.

Practice of beveling of edges by Hand flame cutting and drilling of holes as per drawing.

One job involving marking, shearing and drilling a Gusset plate as per drawing.

Practice of cutting 2mm thick sheet on a marked contour by using portable nibbling machine.

NOTE: Each student should maintain a journal in which report of each job done and experience gained should be systematically recorded.
Practical Examination will be of 3 hours duration on a composite job/ jobs involving different machining operations & flame cutting as mentioned in the curriculum.

REFERENCE BOOKS

1. Basic Fabrication and Welding Engineer by Smith K.J. Longman.
2. Workshop Technology Vol-II: Machine tools by Hajra choudhary S.K. (Asia)
3. Technician Fabrication and Welding by Cooper K.J. Greenwood (Cassel series)
4. Basic Welding and Fabrication By Kenyon W. Pitman.
5. Technician Manufacturing Technology by Scotbolt C.R. Cassell
6. Machine Manuals from Manufacturers
7. Modern Welding by A.D. Althouse, C.H. Turnquist & W.A. Bowditch, The Good heart, Willcox Co.

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(FE403) WELDING TECHNOLOGY -II

RATIONALE: This subject is a continuation of Welding Technology-I which covered the Gas and Manual Metal Arc Welding processes. The content included in this subject would enable the student to understand the commonly used welding process like GTAW, GMAW, submerged arc welding and electro slag welding. Principles of modern welding processes have been included to enable the students to keep abreast with the latest development in the welding technology. Control of distortion has been given due importance besides the topics on welding Jigs and Fixtures. Repairs welding have been included in order to enable the fabrication technicians to carry out repairs of components.

TEACHING AND EXAMINATION SCHEME

Course Code & Course Title	Period/weeks (in Hours)			Total Credits	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
	L	T	P	C	TH	TM	TW	PR	
Welding Technology-II	4	-	4	8	75	25	50	50	200

Content	Hrs	Mks
1. GAS TUNGSTEN ARC WELDING (GTAW) Definition. Principle of operation. Equipment. Base metals welded, Joint design. Shielding gases: Comparison of argon and helium as shielding gases, Shielding gas mixtures, purity of shielding gases, variables influencing minimum effective amount of shielding gas flow. Accessory equipment-welding fixtures, weld backing, automatic welding, longitudinal seamers, pedestal boom manipulators, water hoses. Filler metals- Forms, size and use, storage and preparation. Manual GTAW techniques. Applications. Advantages and limitations. GTAW spot welding: equipment, use of filler metal wire. Use of consumable inserts. Safety practices.	6	8
2. GAS METAL ARC WELDING (GMAW) Definition. Principle of operation. Self-adjusted arc, self-controlled arc. Equipment: Power source, welding torch, wire feed mechanism. Metals welded. Shielding gases: gases used, gas mixtures, cost, supply and storage of shielding gases, need of gas pre-heater in Co_2 gas shielding. Holding and handling work-pieces. Joint design. Comparison of GMAW and Alternative Welding processes. Applications. Advantages and limitations. Safety practices.	6	8
3. SUBMERGED ARC WELDING (SAW) Definition. Principle of operation. Advantages and limitations. Suitable work metals. Equipment. Joint design. Weld backing: Baking Strips, backing weld, copper backing, flux backing, gas backing. Arc starting. Operating variables. Effect of Welding position on joint design and welding conditions. Causes and prevention of weld porosity. Causes and prevention of weld cracking. Comparison of SAW with other arc welding processes. Safety practices.	6	6
4.FLUX CORED ARC WELDING (FCAW)	5	6

Definition. Applicability. Process fundamentals. Power supply. Electrode holders. Wire feed systems. Shielding gas Holding and handling of work pieces. Effect of operating variables. Comparison with other processes.		
5. ELECTRO SLAG WELDING Definition Applicability: Thickness range, length of joint, types of joints welded, specific applications. Principles of operation: Conventional electro-slag welding, electro slag welding by the consumable guide tube. Equipment: Guid-tube(Conventional system),Guid-tube(consumable guide tube system),dams, wire feed system, oscillator mechanism. Electrode wire. Fluxes. Preparation of work piece. Operating procedure: start up, oscillations, number of electrode wires, control of vertical travel. Advantages and disadvantages. Applications.	5	6
6. BASICS OF SPECIAL WELDING Plasma arc welding, Laser welding, Ultrasonic welding. Thermit welding, Atomic Hydrogen welding. Electron beam welding. Underwater welding.	10	10
7.RESISTANCE WELDING Definition. Fundamentals of resistance welding. Advantages and disadvantages. Applications. Resistance spot welding: Definition, Spot Welding cycle, Procedure, Heat shrinkage in spot welding, Heat balance in spot welding, Spot weldable metals. Spot welding methods. Advantages and limitations. Applications. Resistance seam welding- definition, principle of operation, advantages and disadvantages, applications. Projection welding-:Principle of operation, advantages and disadvantages. Applications. Resistance Butt welding-Upset Butt welding: Principle of operation, Applications. Flash butt Welding-principle of Operation, difference between flash and upset welding, advantages and disadvantages, applications. High frequency welding of tubes.	9	9
8. DISTORTION &RESIDUAL STRESSES IN WELDED FABRICATION Concept of distortion: Types of distortion- Longitudinal, transverse, angular, bowing. Causes of distortion: Heat input, restraint, inherent stresses in parent metal. Control of distortion: joint design, assembly procedure: Pre-setting method: Restrained method, welding procedure, welding process, type and size of electrode, welding rod and wire, number and sequences of runs, size of deposit and welding position: welding current and welding speed, welding sequences and techniques. Correction of distortion: Manual, use of press, local heating: Hot shrinkage, use of heat strip, use of heat triangle. Concept of residual stresses. Distortion in cutting: Factors causing distortion, examples of distortion in cutting. Distortion control techniques in cutting: Immersion in water, flushing behind the cut, simultaneous cutting, wedging, step cutting, welding behind the cut, locking the scrap.	6	8
9. WELDING JIGS & FIXTURES Introduction. Welding jigs. Welding fixtures. Principles governing design of good welding jigs and fixtures. Various jigs and fixtures: 'C' clamps, Vee cradle or Rest, rotating fixture, turn table, turn over fixture, positioners, manipulators, quick acting clamps.	4	6
10. REPAIR AND MAINTENANCE WELDING Weldability of metals and Alloys, Importance of Carbon Equivalent, Welding Procedure Qualification. Importance and difference between repair & maintenance welding. Steps involved: Preparation for welding, welding procedure, post-welding operations. Factors influencing the procedure of	7	8

maintenance welding. Precautions in welding. Examples of repair of works- Repairs of hair-line crack in casting, Rebuilding of worn-out shafts, Hard Facing of worn out surfaces.		
Total	64	100

TERMWORK

1. MMAW-a) Vertical position:-V-butt, fillet. B) Overhead position:- Pad building, V-butt, fillet.
c) All position: Pipe to plate, pipe to pipe.
2. GMAW- Flat position: Running beads, V-butt, fillet.
3. GTAW- Flat position: Running fusion runs (without filler), Running beads(with filler), Butt joint of thin plates without filler, Butt joint of thin plates with filler, Fillet.
4. Demonstration of other welding processes: Resistance welding, distortion control in welding operation, Repair welding, Distortion control in cutting operation.
5. One industrial visit to study other welding processes and applications.

PRACTICAL EXAMINATION (3 hrs)

This consist of welding Composite Job having similar exercise to those in Sr. No. 1,2,3 of term work.

TEXT BOOKS

1. A text- book of welding technology by O.P. Khanna Dhanpat Rai
2. Metals Handbook : Vol-VI ASM (Welding, Brazing& Soldering)

REFERENCE BOOKS

1. The Science & Practice of Welding Vol-I & II by A.C. Davis Cambridge University Press.
2. Control of distortion in Welding Fabrication, 2nd Edition, Welding Institute, London.
3. Welding Handbook AWS, section–I
4. Modern Arc Welding Technology by S V Nadkarni (Advani- Oerlikon Ltd.).
5. Welding Journals (Indian Institute of Welding and American Welding Society.
6. Welding Hand: Book Vol.- I toV, American Welding society 550, N.W. Le. Jeune Road P.O. Box 351040 Miami FL33135.

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(FE404) MATERIALS AND PROCESSES

RATIONALE: A Technician in fabrication is involved in the manufacture, repairs and maintenance of various types of structures in the industries. This course is designed to enable students to understand the properties and use of engineering materials, applications and implications of heat treatment in design and fabrication, stress relieving processes and metallurgical aspects of welds. As steel is most used material in fabrication industry, its surface preparation and protection is also given due importance. The properties of other materials are also briefly covered.

TEACHING AND EXAMINATION SCHEME

Course Code & Course Title	Period/weeks (in Hours)			Total Credits	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
	L	T	P	C	TH	TM	TW	PR/OR	
Material & process	4	-	-	4	75	25	-	-	100

Content	Hrs	Mks
1. STEEL MAKING(Brief Description) Pig iron and its manufacture: Blast furnace, steel and its manufacture: The Bessemer Process, The L-D Process and the Direct Electric Arc Furnace Process.	4	6
2. PLAIN CARBON STEEL Iron-carbon equilibrium diagram (steel portion upto 2%C only). Types of solid solutions: Substitutional, Interstitial. Types of structures: Pearlite, Austenite, Cementite, Martensite. Types of plain carbon steel: Low carbon steel, medium carbon steel, high carbon steel and Tools steel (High Carbon) Mechanical properties and Applications of Plain carbon steels in tabular form. Influence of constituents on steel- Carbon, silicon, manganese, sulphur, phosphorus. Factors affecting mechanical properties: Effects of grain size, effect of heat treatment, effect of atmospheric exposure, effect of low temperature, effect of high temperature.	6	8
3.ALLOY STEELS Reasons for alloying in steels. Common alloying elements in steel and their effects. Alloy structural steel, Stainless steel: Austentic stainless steel, Martensitic stainless steel, Ferritic stainless steel, Molybdenum leaded stainless steel, Low carbon stainless steel, stabilized stainless steel. High speed steel- Effects of alloying elements on high speed steel. Heat resisting steels.	6	8
4.CAST IRON Grey cast iron. White cast iron. Malleable cast iron: White heart, Black heart. Nodular iron or Spheriodal graphite iron. Chilled cast iron. Alloy cast iron.	4	6

5. METALLURGY OF WELDING Introduction. Heat flow in and around weld metal: Temperature distribution, cooling rate of weldments. Weld metal solidification: Concept of Epitaxial growth and competitive growth. Absorption of gases by welds: Sources of gas effects of gas absorption: Hydrogen, nitrogen, oxygen, prevention of gaseous contamination. Thermal effects of welding on parent metal and its mechanical properties: Weld metal Zone, Heat affected Zone(HAZ), Unaffected Parent Metal. Hydrogen Embrittlement and cracking. Weld cracking. Corrosion of Welds: Definition, Types of corrosion in welded joints, factors influencing corrosion resistance of welded joints, concept and prevention of weld decay. Stress relief Heat Treatment of weldments- Need for stress relief, methods to reduce welding stresses: Peening, vibratory stress relief, thermal treatment, thermo mechanical treatment, over-stressing technique.	12	12
6. HEAT TREATMENT OF STEEL Definition of heat treatment. Need for heat treatment. Isothermal Transformations: TTT-Curves, Transformation upon continuous cooling. Factors affecting good results: heating temperature, soaking time, rate of cooling. Quenching media: water, oil, brine and air. Hardening process: Heating methods - Furnaces, salt bath and induction. Effects of Carbon, alloying elements and cooling rate on hardenability. Change in properties after hardening. Tempering process: Reasons, effects and types of tempering. Normalising process: Reasons, effects and methods of normalising Annealing process: Reasons for annealing, change in properties, full annealing, process annealing (Recovery, re-crystallization and grain growth). Martempering process and Austempering process.	10	10
7. AGE HARDENING OR PRECIPITATION HARDENING Brief description using Al-Zn or Al-Cu system. Effect of time and temperature of ageing treatment on the mechanical properties. Practical applications.	2	3
8. COLD AND HOT WORKING Work hardening or strain hardening, Recovery, Recrystallization temperature. Difference between Cold working and Hot working. Need of Process annealing in cold working. Cold working processes (brief description only): Cold rolling, Cold pressing and spinning. Hot working processes (brief description only): Hot rolling, Forging and Extrusion.	4	6

9. STEEL SURFACE PREPARATION & PROTECTION. Introduction, Mechanical cleaning of steel: Shot blasting, Sand blasting, Slag blasting, Hydroblasting, Barrel tumbling, Rotary blasting. Chemical cleaning of steel: Degreasing, descaling, acid pickling. Electrolytic cleaning, electrolytic degreasing and Electrolytic pickling of steel. Cathodic and Anodic protection of steel: Basic theory , Cathodic protection, Sacrificial anode protection and impressed Current Cathodic protection(ICCP). Protection by Barrier Coatings: Requirements of Coatings, Painting, powder coating, Galvanizing. Phosphating, zinc plating, chrome plating.	10	10
10. OTHER MATERIALS Plastics and Polymers. Insulating materials. Thermocole. Glass. Refractory materials and Ceramics. Timber. Composite materials (FRP and GRP), Rubber.	6	6
Total	64	75

NOTE:- For Examiners: Due weightage for every topic as mentioned in the syllabus should be given.
Minimum two Industrial visits in a term, to suitable Industries/Erection sites or Quality Testing Centers should be arranged by the Institution.

REFERENCE BOOKS
Latest editions of recommended reference books are to be made available in the library.

1. Materials and Processes S.K. Hajra, Choudhary India Book Distributing Co. Calcutta.
2. Welding Technology, O.P. Khanna, Dhanpat Rai and Sons, Delhi.
3. The Surface Treatement of steeel by Eric M. Simons.
4. Corrosion Prevention Practice by G. A. Balalaev.
5. Material Science and Metallurgy By Dr. O.P. Khanna.
6. Engineering Metallurgy Part I, R.A. Higgins ELBS Edward Arnold.
7. American Society of Metals Hand Book, Vol. 11-Non- Destructive Inspection and quality Control.

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(CE402) MATERIALS AND STRUCTURES

1. RATIONALE

The course content comprises of the study of fundamentals of theory of elasticity and the
response of the Structural Components when subjected to service loads of tension, compression and shear loading. The study of determination of centroid, centre of gravity and Moment of Inertia of sections is included which is pre-requisite to determining bending and shear stresses in structural components. The knowledge of the relationship between the applied loading and the resulting effects in the structural components shall assist in the realistic analysis leading to safe and economic design of structures. The laboratory exercises have been designed to study the properties of the basic structural materials and their behaviour under different types and stages of loading which is of vital importance to a successful Civil Engineer.

2. TEACHING AND EXAMINATION SCHEME

Course code & course title	Periods/Week (in hours)			Total Credits	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
MATERIALS AND STRUCTURES	L	T	P	C	TH	TM	TW	PR/OR	125
	4	-	2	6	75	25	25		

Minimum passing %: Theory 40% *Duration of theory paper: 3 Hrs.*

Legends:
***L**-Lecture; **T** - Tutorial; **P** - Practical; **C**- Credit; **TH**- End Semester Theory; **TM** – Test Marks:*
***PR/OR** - End Semester Practical / Oral Examinations; **TW-** Term Work*

3. DETAILED COURSE CONTENTS

Unit 1 Stresses and Strains

Definition of rigid, elastic and plastic bodies, deformation, internal resistance, stress and strain. Axial Loading- Tension, Compression, tensile and compressive stresses and strains, stress distribution. Stress- Strain relationship, Hooke's Law, Modulus of elasticity. Concept of shear loading and deformation, shear stress, shear strain, modulus of rigidity.
Longitudinal strain, lateral strain, Poisson's ratio, Concept of Biaxial and Triaxial stress (No derivations & Numerical Problems),Volumetric strain, Bulk Modulus, relation between modulus of rigidity and Young's Modulus. Stresses and strains in composite sections subjected to axial loading. Temperature stresses and strains in homogenous section.

Unit 2 Strain Energy

Concept and definition of strain energy. Strain energy stored due to gradual, sudden and impact loading, Proof resilience and modulus of resilience.

Unit 3 Centroid, Centre of Gravity & Moment of Inertia

Definition of Centroid, Determination of Centroid of plane regular lamina, cut-outs and built-up lamina. Definition of Centre of Gravity. Determination of Centre of Gravity of filled regular solids, solids with holes and built-up filled solids. Concept of Moment of Inertia, Parallel axis theorem and Perpendicular axis theorem, Polar Moment of Inertia, Radius of Gyration. Moment of Inertia of rectangular, circular and triangular section.(No Derivation). MI of sections –Angle section, I section, Channel, Tee section and built up section with and without flange plates.

Unit 4	**Shear Force and Bending Moment**
Definition of beam. Types of beams- Cantilever, Simply Supported, Simply Supported with overhang, Fixed and continuous. Types of Loading- UDL, Point Load and Equivalent load. Definition of shear force and bending moment, sign convention. S.F.D. & B.M.D. for cantilever, simply supported and overhanging beams subjected to point loads, uniformly distributed loads and moments determining point of contra flexure. (Analytical & graphical method, No problems on graphical method in theory paper)	
Unit 5	**Bending Stresses in Beams**
Theory of simple bending, definition of pure bending, Neutral plane, neutral-axis, bending plane and bending axis, stress and strain due to bending. Section modulus for rectangular, circular and Symmetrical I section. Assumptions made in theory of simple bending, The bending equation and its use, concept of moment of resistance, bending stress diagrams. Flexural rigidity, beam of maximum strength and beam of uniform strength, Calculation of maximum bending stress in beams of rectangular, circular, I and T section, Permissible bending stress	
Unit 6	**Shear Stress in Beams**
Shear stress equation, Meaning of the terms in the equation, Shear stress distribution for rectangular section, hollow rectangular section, circular section, symmetrical I section and Tee section. Relation between maximum and average shear stress.	

4. SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)

Unit No.	Unit	Teaching Hours / Semester	Marks
1	Stresses and strains	16	15
2	Strain Energy	8	6
3	Centroid, Centre of Gravity & Moment of Inertia	12	15
4	Shear Force and Bending Moment	12	15
5	Bending Stresses in Beams	8	12
6	Shear Stress in Beams	8	12
		64	75

5. LIST OF EXPERIMENTS

(A) 1. Tension test on mild steel
2. Compression test on concrete, timber & brick.
3. Charpy test & Izod Test
4. Brinell hardness test & Rockwell hardness test
5. Shear test on mild steel specimen
6. Bend test

(B) Four Half Imperial Drawing Sheets on:
1. Graphical solution of problems on Shear Force and Bending Moment diagrams, for simply supported, cantilevers, and overhanging beams subjected to point loads and uniformly distributed with analytical calculations.

6. LEARNING REFSOURCES

S.No.	Author	TITLE OF BOOKS	Publication
1	S. B. Junnarkar	Mechanics of Structures volume – I	Charotar Publishing House, Anand, Gujarat
2	S. Ramamrutham	Strength of Materials	Dhanpat Rai & Sons, New Delhi
3	R. S. Khurmi	Strength of Materials	S Chand
4	Vazirani and Ratwani	Analysis of Structures	Khanna Publishers , New Delhi
5	Chakraborty	Strength of Materials	
6	S S Bhavikatti	Strength of Materials	Vikas Publishing House Pvt. Ltd., Noida (UP)

(CS 305) COMPUTER AIDED DRAFTING

1. RATIONALE:

The market driven economy demands frequent changes in product design to suit the customer needs.With the introduction of computers the task of incorporating frequent changes as per requirement is becoming simpler. This course has been introduced at Diploma level to develop the skills in student so that they can generate various digital drawing s as required using various CAD software.

3. Teaching and Examination Scheme

Course Code & Course Title	Periods/ Week (In Hours)			Total Credits	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
CS305 COMPUTER AIDED DRAFTING	L	T	P	C	TH	TM	TW	PR/OR	100
	0	-	4	4	-	-	50	50(P)	

Minimum passing % : Theory 40% *Duration of Theory Paper: 3 Hrs.*

2. COURSE CONTENTS: Teaching hours

1. Introduction and CAD Preliminaries. 2 hours

- Computer aided drafting concept.
- Hardware and various CAD software available.
- Components of a CAD software window such as Titlebar, Standard toolbar, Menu bar, Object properties toolbar, draw tool bar, Modify toolbar, Cursor cross hair, Command window, status bar, Drawing area,UCS icon.
- File features: New file, Saving the file, Opening an existing drawing file, Creating Templates, Import and Export of file, Quit.
- Setting up new drawing : Units, Limits, Grid, Snap.
- Undoing and Redoing action.

2. Drawing using CAD software: 10 hours

- Drawing basic objects : Point, Line, Circle, Arc, Ellipse, Parabolas, polygon, Rectangle, Multiline, Doughnut, Drawing with precision, Drawing construction lines and rays, Calculating distance and angle, Use of measure, Divide, Inquiry commands, redraws and Regenerating screen display.
- Methods of specifying points, Absolute coordinates, Relative Cartesian, and Polar coordinates.
- Using Object snap: Endpoint, midpoint, Intersection, Centre Point, Quadrant point, Nearest Perpendicular, Apparent Intersection, etc.

3. Edit/modify features and viewing drawings. 10 hours
   - Object Selection : selection set with its options like Pick box, Window, Crossing, Previous, Last drawing, etc.
   - Editing Commands like : Zoom all, Zoom Previous, Zoom Extents, Zoom window, Zoom real time, Zoom Dynamic, Zoom Pan.
   - Modify commands: Erase, Copy, Mirror, Offset, Array, Move, Scale, Stretch, Lengthen, Trim, Extend, rotate, break, join, chamfer, fillet.

4. Organising Drawing: 6 hours
   - Concepts of layers: creating layers, naming layers. making layers ON/OFF, freeze-thaw layers, lock/unlock layers, setting the properties of layers like colour, line type, line weight.
   - Concept of blocks : Creating, inserting, redefining and exploding blocks.
   - Concept of Hatch: Selecting hatch pattern, Hatch styles, Hatch Orientation, associative hatch, Boundary hatch, Hatching Object.
   - Polylines: Drawing polylines, editing polylines, drawing spline curves, editing splines.

5. Dimensioning and Tolerancing 8 hours

- Dimensioning : Types of dimensioning, Linear, Horizontal, Vertical, Aligned, rotated, Baseline, continuous, diameter, radius, angular dimension, Leader.
- Dimension scale variable,adding geometric tolerances
- Editing dimensions
- Single line text,Multiline text.
- Text styles: selecting font, size, arrows, alignment, etc.

6. 3D-features 2 hours

- Right hand rule/local global co-ordinate system.
- Specifying 3D coordinates
- Using UCS
- Defining user coordinate system using UCS command with its options.
- Viewing in 3D

7. Isometric Drawing: 10 hours

- Settings for isometric drawing, isometric Snap mode, switching between isometric planes, isocircles, simple isometric drawings.

8. Solid Modeling 12 hours

- Concept of solid modeling
- Creating predefined solid primitives such as box, cone, cylinder, sphere, torus, wedge.
- Constructing a region, creating an extruded solid, creating a revolved solid.
- Creating composite solids using union, intersection and interface commands.

9. Model space, Paper space, viewports and layouts 2 hours

- Concept of model space and paper space.

- Creating viewports in model space and creating floating viewport in paper space.
- Shifting from model space to paper space and vice versa.

10. Printing/ Plotting drawing. 2 hours
    - Standard sizes of sheet.
    - Selecting various plotting parameters such as paper size, paper units, drawing orientation, plot scale, plot offset, plot area, print preview.

3. PRACTICALS

1. Drafting of common template for all the following assignments with Institute logo and standard title block.
2. Five problems on different geometrical shapes.
3. Dimensioning of above figures.
4. Three problems with polar and rectangular arrays.
5. Three problems on 2D entity generation, which involve the use of layers and blocks.
6. Two problems on orthographic views for various Engineering drawing objects covering dimensioning, text, etc.
7. Two problem on isometric drawing of Engineering drawing object.
8. Create at least two solid models, which cover all the features available in solid modeling.
9. Drafting project:
    a) Civil Engg. & Architectural Engineering: Plan, elevation and section of a single story residential building.
    b) Electrical & Electronics Engg.: Electrical layout of components like bulbs, fan, A.C., T.V. point, telephone point, etc. for a single story house.
    c) Mechanical Engg.: Industrial components such as machines, automobiles , jigs and fixtures with dimensioning, tolerancing ,text, title block, etc.
    d) Shipbuilding Engg.: Body plan of a ship.

e) Mining Engg.: Plan and section of an opencast mine benches, Plan and section of an underground mine.

f) F.T.E.E. : Front View and Bottom View of a Simple truss like Saw Tooth truss, King-Post truss, Snow Tooth truss. (Any one of the three)

4. LEARNING RESOURCES

1. AutoCAD for Engineering drawing made easy – P. Nageshwar Rao- Tata McGraw Hill.
2. Mastering AutoCAD – George Omura- BPB Publication.
3. AutoCAD 2004 – Sham Tickoo- Galgotia Publications, New Delhi.
4. AutoCAD 2000 – Devid Frey- BPB Publication.
5. An Introduction to AutoCAD 2000 – A. Yarwood- Longman publication.
6. Using AutoCAD 2000 – Ron House – Prentice Hall.
7. Latest AutoCAD Manual – Autodesk Inc. – Autocad Inc.
8. CATIA V6 Essentials by Jones & Bartlett learning.
9. Inside Catia by Paul Carman, Paul Tigwell.
10. CATIA Tutorials by Nader G. Zamani.
11. ProE/Creoelements or any equivalent reference/text books.

(CS 311) ELEMENTS OF CIVIL ENGINEERING

1. RATIONALE:-

A broad based knowledge of elements of civil engineering is essential for Electrical/ Fabrication/ Air- conditioning engineering technicians. They are required to carry out the planning and layout of the power supply lines, supervise the erection of transformers and towers including providing foundations for these structures and heavy machinery. They are also required to select suitable construction materials on the field. Hence it is essential to gain adequate knowledge on reading the plans, foundations, setting out of lines, and measurement of land, concrete, structural frameworks, fire protection and insulation in buildings.

2. TEACHING AND EXAMINATION SCHEME

Course code and Course Title	Periods / Week (in hours)			Total Credits	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
Elements of Civil Engineering (CS 311)	L	T	P	C	TH	TM	TW	PR/OR	125
	3	--	2	5	75	25	25	--	

Minimum passing % : Theory 40% Duration of Theory paper: 3 hours

L: Lecture, T: Tutorial, P: Practical, C: Credits, TH: Theory paper, TM: Test marks, PR/OR: Practical or oral examination, TW: Term work.

3. DETAILED COURSE CONTENTS

Unit 1. **Surveying**

Definition of surveying, objects of surveying, uses of surveying, principle of Surveying, classification of surveying.
Methods of linear measurements, instruments for Linear measurement
Ranging:- Direct and Indirect (Reciprocal) Ranging
Measurement of distances with chain, tape and other instruments.
Chaining along a sloping line, to continue a line, measurement of the distance past an obstacle like building, valley etc.

Unit 2. **Compass Surveying**

Introduction and purpose, definitions: Geographic Meridian, Magnetic Meridian, Arbitrary Meridian
Knowledge of Bearings i) Whole circle Bearing ii) Quadratic or Reduced Bearing, study and use of Prismatic Compass. Local attraction, Fore bearing and Back bearing, computation of included angles.

Unit 3. **Levelling**

1. Definition of technical terms in concept of leveling, A level line and a horizontal line, A level plane and a horizontal plane, Bench Mark and types, Backsight, Foresight, Intermediate sight, Change point, Instruments used for leveling – dumpy level, Tilting level, leveling staff Temporary adjustment of a dumpy level. Methods of Simple Levelling and Profile Levelling.
2. Calculation of reduced levels in a Levelling book by : (i) H.I. method (ii) Rise and fall method.

Unit 4 **Theodolite Surveying**

Introduction of theodolite, definition of technical terms in theodolite surveying: Line of collimation, Transiting, swinging, Face left and Face right observations, Study of a Transit theodolite and its parts.
Temporary adjustment of theodolite
Measurement of vertical angle, Measurement of horizontal Angle, Prolonging a straight line, checking vertically of poles or towers, computation of height of a tower by vertical angles and distance

Unit 5. **Building Construction**

Types of buildings: Load bearing and framed structures.
Components of building: Foundations, walls, columns, beams and slabs, roofs, flooring.
Foundations – Definition, purpose of foundation, bearing capacity of soils- ultimate bearing capacity , safe bearing capacity of soil
Types of foundation – Shallow foundations: spread footing, column footings, Raft foundation, Grillage foundation, Deep foundations: piles,
Types of piles: Floating piles and End bearing piles, cast in situ piles and precast piles, cased and uncased piles, Caissons.
Flooring:- Types of floorings, flooring for Residential buildings, Office buildings, Factories, workshops and ware houses, Auditorium.
Roofs and Roofs coverings:-Classification of roofs: Flat and pitched roofs.
Roofs supporting structures- wooden and steel trusses, line diagram of various types of steel trusses: Fink, Pratt, Howe, Lattice girder, Northlight roof truss etc.
Roof covering: AC, G.I. Acrylic sheets, , Glass fiber sheets, aluminium sheets.

Fire Protection :- Fire resisting construction. Fire protection requirement / Measures for multi stored building and Industries
Insulation in Building: – Thermal insulation – material used, Sound insulation – material used Acoustical design of auditorium.

Unit 6. **Concrete Technology**

Types of Concrete, Ingredients of Concrete, Grades / Mix proportions of Concrete for various purposes.
Concreting: mixing, transporting, placing, compacting, curing, importance of water cement ratio. Concept of RCC, Pre-stressed Concrete. Grouting and its use.

Unit 7, **Building Drawing**

Elementary idea about Building, Plan Elevation and section, Symbols / conventions used including symbols for electrical fixtures. To draw elevation, plan and sectional details of two room residential building, Layout of an industrial building.

4. SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)

Unit No.	Unit	Teaching Hours	Marks
1	Surveying	5	6
2	Compass Surveying	5	8
3	Levelling	8	12
4	Theodolite Surveying	10	9
5	Building Construction	12	20
6	Concrete Technology	4	8
7	Building Drawing	4	12
	Total	48	75

5. TERMWORK

Term work shall consist of practice on various topics mentioned below: student are required to maintain a journal where field observations / calculations are recorded.

1. Measurement of distance with chain
2. Chaining on a sloping ground
3. Reciprocal ranging
4. Study of compass and observation of bearings
5. Study of Dumpy level and simple levelling
6. Study of theodolite & observation of horizontal and vertical angles
7. Checking verticality of tower using theodolite and chain.
8. Prolonging a straight line using theodolite

A SKETCH BOOK CONTAINING THE FOLLOWING:

1. Signs and symbols used in Civil Engineering including electrical fittings
2. Spread footing of a wall
3. Column footing – an isolated and a combined
4. Raft foundation – Plan and a section
5. Grillage foundation
6. Line diagram of various roof trusses.
7. Section of a wall from foundation to roof, showing all the levels
8. Development of a plan, elevation, and section of a small residential building from a given line plan.

6. LEARNING RESOURCES

S.No.	Author	Tittle of the book	Publication
1	B.C. Punmia	Surveying Vol I & II	Laxmi Publication Ltd.
2	S.K. Duggal	Surveying Vol I & II	Mc. Graw Hill Education
3	N.N. Basak	Surveying & Levelling	Mc. Graw Hill Education
4	Sushilkumar	Building Construction	Standard publishers and Distributers
5	S. Ramamruthum	Building Construction	Dhanpat Rai & Sons
6	S.C. Rangawala	Building Construction	Charotar Publishers
7	Kale Shah & Patki	Building Drawing (V Edition)	Tata Mc.Graw Hill education

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Semester:- V

Course code	Name of Course	EXAMINATION SCHEME				Total
		TW		PR/OR		
		Daily Diary	Progressive Assessment	Training Report	Report Assessment & Seminar/Viva	
FE501	Fabrication Inplant Training -I	50	50	50	50	Grade

Semester :- VI

Course code	Name of Course	TEACHING SCHEME				EXAMINATION SCHEME				Total marks
		L	T	P	C	Theory marks		Practical marks		
						TH	TM	PR/OR	TW	
FE601	Theory of Structure-I	4	-	1	5	75	25	-	25	125
FE602	Fabrication Estimation & Costing	4	-	2	6	75	25	25 (O)	25	150
FE603	Erection Engg.	3	-	4	7	75	25	25	25	150
FE604	Quality control & inspection	3	-	2	5	75	25	25	25	150
FE605	Fabrication Workshop Practice	-	-	4	4	-	-	50	50	100
E1	Elective-I	3	-	-	3	75	25	-	-	100
	Total	**17**	**-**	**13**	**30**	**500**		**275**		**775**

ELECTIVE I

CS601 Industrial Organization &Management

FE511 Operation Research

FOR INDUSTRIAL TRAINING OF VTH& VIIITH SEMESTER:

1. Grades will be awarded based on marks scored as follows:
   a. 80% and above Marks – Grade 'A'
   b. 60% to 79% Marks – Grade 'B'
   c. 40% to 59% Marks – Grade 'C'
   d. Marks below 40% - Grade 'D'

2. TW and PR/OR shall be separate Heads of passing. Student has to secure minimum Grade 'C' for passing.

3. Student with Grade D under the Head TW, shall be declared T.N.G. and a student whose term is granted but obtains Grade D under the head PR/OR, shall be declared Failed/ATKT.

SEMESTER V

(FE501) FABRICATION INPLANT TRAINING –I

Course code	Name of Course	EXAMINATION SCHEME				Total
		TW		PR/OR		
		Daily Dairy	Progressive Assessment	Training Report	Report Assessment & Seminar/Viva	
FE501	Fabrication Inplant Training -I	50	50	50	50	Grade

RATIONALE:- The diploma programme has been designed as a sandwich programme. The students are required to undergo industrial training for two terms in fifth and eighth terms. The industrial training has been included as a compulsory component of the curriculum in order to cater to the needs of some of the activities, which cannot be taken up in the institution. At the same time, it is expected that the students will develop right attitudes through this process. It is assumed that the employability of the students will increase because of industrial training.

Objectives:- To orient the students with the environment of the industry and make them familiar with the current industrial processes and practices. To study the equipment/ machines processes which cannot be demonstarated in the institution.To provide opportunity to the students to solve the industrial problems.To develop right type of attitudes.To collect information/ data for project work and seminars.

Students are expected to perform the following jobs/ assignments/ activities during the training period.

1. Study of various departments and their functions in the industry.
2. Receipt, Inspection and handling of raw materials.
3. Storage of raw materials.
4. Production planning procedures.
5. Processing and production of the various products in the industry.
6. Study and interpretation of fabrication drawings.
7. Quality Control procedures.
8. Maintenance of Machinery and equipment‘s
9. Safety measures being followed in the industry.
10. Procurement and marketing procedures.
11. Management aspects of the industry.
12. Scrap disposal procedures being followed in the industry.

A. The Approximate Time allocation :

Orientation in the Institue	1 day
Training in the industry	22 weeks
Report writing and preparation for seminar presentation in the Institute	2 weeks
	Total - 24 Weeks

B. Distribution of Marks:

Daily Dairy	50 Marks
Progressive Assessment	50Marks
Training Report	50Marks
Report Assessment & Seminar/Viva	50 Marks
Total 200 Marks	

C. Daily Diary :

The trainees should maintain a daily diary in the notebook provided by the institution. It should contain a brief account of observations and activities performed everyday by the trainees , to the satisfaction of the supervising authorities in the industry. It should be shown to the supervising authority for counter signature at least once in a week.

D. Assessment:

The assessment of progress a should be done periodically at least twice during the training period approximately once every two months . The trainees should deliver seminar and submita interim report at the end of 8^{th} and 16^{th} week of the training to the lecturer –in- charge for training at the Institute. The interim report shall be written by referring the daily diary, which is maintained by the trainee. Later, the lecturer in charge and supervising authority of industry shall assess the progress of student either independently or in consultation based on the performance & qualification factors suggested below.

E. Seminar:

The Trainee is allowed a minimum, time of 15 minutes to explain and elaborate the work experience gained by him during the training period. A panel of two examiners, (one from the industry and one from the Institute) shall assess the seminar presentation , for maximum of 50 marks .

F. Training Report:

The same panel of examiners shall assess the impact of training on the trainee based on the report presented by him, along with a viva during the seminar presentation and also assess the report. The report should be informative and technical neatly hand-written on good quality paper with its length approximately 50 pages, preferably with figures, graphs or photographs.

Assessment of Training Report be based on Knowledge, Presentation, Quality of contents and Sketches.

The Numerical Rating

Evaluation Criteria	**Max. Mks.**	**Poor**	**Average**	**Good**	**Excellent**	**Marks Obt.**
Quality of work accomplished	9	0-1	2-4	5-7	8-9	
Quantity of work accomplished	9	0-1	2-4	5-7	8-9	
Job Knowledge	9	0-1	2-4	5-7	8-9	
Dependability	3	0	1	2	3	
Creativity	3	0	1	2	3	
Punctuality/ Attendance	5	0	1-2	3-4	5	
Job Analysis and Judgement	3	0	1	2	3	
Initiative	3	0	1	2	3	
Communication Skills	3	0	1	2	3	
Personality development	3	0	1	2	3	
Total	50	Total Score out of 50				

Guide lines for writing the Report:-

1. A Xerox copy of the training certificate issued by the industry.
2. Contents with page numbers.
3. Introduction of the Industry.
4. Organization structure.
5. Different Eqpt,/m/c/tools encountered: sketches/ photographs, specifications, applications.
6. Production processes employed
7. Safety measures observed.
8. Specific areas of Interest/ Assignments/ Projects undertaken.
9. Experiences gained.
10. List of figures/ graphs.
11. List of tables.
12. Acknowledgement.
13. References.

Note for trainees-The attendance should notbe less than 75% of 24 weeks of the training period

(Working days only being considered). Absence due to sickness shall not be considered towards attendance.

Note for Inspection Authorities of the Institute:- Surprise visit at random shall be conducted by the

Inspection Authorities of the Institute at least once in a month.

SEMESTER VI

(FE601) THEORY OF STRUCTURES-I

1. Rationale :- The course content comprises of the study of determination of stresses on a structure subjected to eccentric loading in columns, tension members, bridge peirs and chimney structures. Complex stress system useful in the shafts, welds, bolts of steel structure, the knowledge of behavior of shafts under torsion . Furthermore coarse contents comprises of study of ILD and rolling loads, stability of structures which will develop cognitive ability and skills to facilitate higher level study of design of structures. Also concept of thick and thin cylinders is added to catch to the fundamental knowledge leading to design of pressure vessel and boilers.
2. Teaching and Examination Scheme:-

Course code & Course Title	Periods/ weeks in hours			Total Credits	Examination Scheme				
					Theory Marks		Practical Marks		Total
FE601 Theory of Structures	L	T	P	5	TH	TM	TW	PR/OR	125
	4	-	1		75	25	25	-	

Minimum passing % : Theory : 40 % Duration of theory paper : 3 Hrs.

Legends.

L-Lecturer, T- Tutorial, P- Practical, C- Credit, TH-End Semester Theory, TM-Test Marks, PR/OR- End Semester Practical / Oral Examination. TW- Term work.

3. DETAILED COURSE CONTENTS:-

Unit 1.Combined Bending and Axial loading .

Eccentric load, Eccentricity, different cases of structures subjected to bending and axial loading. Eccentricity about one axis, standard cases of stress distribution, determination of maximum and minimum stress in columns, tension member and brackets.

Eccentricity about both axes, determination of extreme intensity stresses at all corners in a column, limit of eccentricity, middle third rule, middle quarter Rule, Core and Kernel of section for rectangular circular, hollow circular and hollow rectangular column. Wind pressure, coefficient of wind resistance, Stresses in chimney structures.

UNIT 2. COMPLEX STRESS SYSTEMS

Uniaxial stress system, resolution of stresses on oblique plane, magnitude and direction of stresses on a oblique plane. Biaxial direct stresses, General two dimensional stress system.

Normal, tangential stresses on a oblique plane. Magnitude and direction of resultant stresses, maximum obliquity of resultant stress system.

Location of Principal planes, maximum shear plane and magnitude of major and minor principal stress and maximum shear stress in two dimensional stress system by analytical method only.

UNIT 3. INFLUENCE LINES FOR BEAM AND ROLLING LOADS.

Influence lines (definition), basic concept of use of influence lines. ILD for simply supported beam for beam reaction at support, for shear force and bending moment at a given section of beam.Calculation of shear force, reactions and bending moments for fixed load positions using ILD.

Concept of rolling loads. Determination of maximum SF and maximum BM at a given section for simply supported beam for a single concentrated load, two concentrated loads spaced at same distance apart, partial UDLs and UDL between and beyond support. Absolute maximum BM in Beam and maximum SF in beam.

Unit 4 STABILITY OF STRUCTURES.

Types of structures, determinate and indeterminate structure. Internal and external stability of structure, Degree of Indeterminacy, degrees of freedom. Determination of external DOI and internal DOI. Uses of indeterminate structures.

UNIT 5 TORSION OF CIRCULAR SHAFTS

Concept of pure torsion, assumption in theory of pure torsion, torsion equation, strength of circular solid shaft and hollow shaft in pure torsion. Shear stress distribution . Polar modulus, torsional rigidity, power transmitted by shaft, Advantages of hollow circular shafts.

UNIT 6 THIN& THICK CYLINDERS

Definition of thin cylindrical shell, stresses in thin cylindrical shell, Rivetted shells, stresses in thin spherical shells.

Definition of thick cylindrical shells, stresses in thick cylindrical shell and pressure distribution.

4. SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)

Unit No.	Unit	Teaching hours/ Semester	Marks
1.	Combined bending & Axial loading	12	15
2.	Complex Stress System	14	15
3.	Influence Lines/ Rolling Loads	14	15
4.	Stability of Structures	06	09
5.	Torsion of circular Shafts.	10	12
6.	Thin & Thick cylinder	08	09
		64 hrs	75 marks

5. TERM WORK

1) Practice on problems of eccentrically loaded columns about one axis and both axis.

2) Sketch of core-kernel of various sections of columns.

3) Practice on problems of complex stress systems of determination of principal stresses as well as normal & tangential stresses.

4) Practice on determination of reactions, bending moments, shear force, absolute bending moment of simply supported girder using ILD.

5) Practice on determination of external and internal degree on indeterminacy.

6) Practice on problems of shafts subjected to torque.

7) Sketch of thin & thick cylinder with stress distributions.

6. LEARNING RESOURSES

Sr. No.	Author	Title of Books	Publications
1.	S. Ramamrnthan	Strength of Materials	DhanpatRai& Sons, New Delhi
2.	Vazirani&Ratwani	Analysis of Structures	Khanna Publishers New Delhi
3.	Dr. Sadhu Singh	Strength of materials	Khanna Publishers New Delhi
4.	S.S. Bhavikatti	Strength of materials	Vikas Publishing House Pvt. Ltd. Noida (UP)
5	R.S. Khurmi	Analysis of Structures	S. Chand & Company Ltd. Delhi.
6	S.P.Timoshenko	Theory of Structures	McGraw Hill
7	R.S. Biyani	Theory of Structures	VrindaPublicaiton , Jalgao

(FE602) FABRICATION ESTIMATION & COSTING

1. **Rationale**: A technician in a fabrication and erection industry is required to prepare various types of estimates for steel structures and also to find out the costs before the proposal for the execution of work. The course content is designed to give necessary knowledge in the preparation of estimates for fabrication work including machining, welding, riveting and other processes. The term-work on practical fabrication work bring the student still closer to the real situation in the Industry. Included in the course are knowledge of various types of contracts and the conditions of contracts.

2. **Teaching and Examination scheme**

Course Code & Course Title	Periods/ weeks in Hours			Total Credits	Examination Scheme				
					Theory marks		Practical marks		Total marks
FE602 Fabrication Estimation & Costing	L	T	P	C	TH	TM	PR/ OR	TW	
	4	-	2	6	75	25	25	25	150

Minimum passing %: Theory 40 % & Practical 40%. Duration of Theory paper: 3 hrs

3. **Competency to be developed through this course:**

Preparation of Estimates and Bills for structural fabrication work and cost of machining work, welding work and for sheet metal work.

4. **Detailed Course Content:**

1.ELEMENTS OF ESTIMATING

Concept of Estimating, its purpose, Function of Estimator, Functions of Estimating Department and Procedure of Estimating.

2.ESTIMATION OF BASIC COST IN MACHINE SHOP

Introduction. Machine time - Machining time for various operations –cutting speed, feed, depth of cut, length of cut; estimation of time for lathe operations –turning, facing, drilling, boring, threading; estimation of drilling time on drilling machine; estimation of shaping, planning and slotting time; estimation of grinding time; estimation of milling time; Numerical examples; Allowances - personal, fatigue, tool changing and grinding, loading and unloading , measurements and checking, etc.

3.ESTIMATION OF BASIC COST OF WELDING

Components of welding cost - labour, consumables.Basic costing procedure - arc welding, gas welding. Factors affecting welding cost. Numerical examples.

4.ESTIMATION OF BASIC COST OF SHEET METAL WORKS

Sheet metal operations, Sheet metal joints. Press work operations. Estimation of Sheet metal operation time.Numerical examples.

5. COSTING

Concept of costing.Objectives and Advantages.Methods of costing. Elements of costing – materials cost, labour cost, overhead cost. Depreciation - causes of depreciation, Methods of calculating depreciation – Straight-line method, Reducing balance method, Production based method (per unit, per hour), Annuity method, Sinking fund method, Revaluation method, Sum of the digits method. Numerical examples.

6. EQUIPMENT REPLACEMENT POLICY

Introduction. Break Even theory. Break Even chart. Reasons for replacement.Steps in carrying out replacement studies.Methods of Replacement studies.Beyond economical repairs.

7. ESTIMATION OF STRUCTURAL STEEL WORK

Definition of Estimation, types of estimation, Revised Estimate and Supplementary Estimate.

Purpose of estimations, Factors affecting estimation. Units of measurement for steel plates, rolled joists, channels, angles, flats and compound girders, tubular structures, sliding doors, shutters, collapsible gates, grid flooring, grills; expanded metal work, plain sheets, chequered plates; holding down bolts including nuts and washers; wedging up under stanchion bases, or steel grillage; rivets and counter sunk rivets; welding ;bends; cables, guy wires and barbed wires. Estimation of Quantities of Structural steel as per IS- 1200 part VIII specification. Measurement Page, Abstract page.Preparation of Bills.P.W.D. method of abstracting.

8.CONTRACTS AND CONTRACT DOCUMENTS

Definition.Requirements of valid contract. Contract document (Brief explanation) – Tender notice, General Rules and directions for the use of contractors, forms of contract, conditions of contract, schedule of materials supplied by owner, bills of quantities. Specification.Fabrication and erection drawings. Types of contracts - Lump-sum contract, Percentage rate contract, Item rate contract, All in contract, advantages and disadvantages of the above contracts. Conditions of contracts- Security deposit, Time limits - Time for completion, delays and extension of time, modes of measurement, terms of payments levy of penalty/liquidated damages for delayed completion and concept of payments of bonus for early completion, alterations, additions and omissions, execution of work, guarantee for performance and service, Breach of contract and arbitration.

9. **TENDER NOTICE**

Meaning of tender notice, information given in tender notice. Invitation for tender - by advertising for competitive tenders, by inviting from selected contractors, by negotiating a contract with selected contractor. Submission of tenders - Single cover tender bid, Two cover tender bid, Earnest money, deposits, technical negotiations, commercial negotiations.

5. TERM WORK

1. Problem on machine shop estimation covering all the operations.

2. Problems of welding estimation.

3. Problem on sheet metal shop estimation.

4. Complete estimation of the steel structure (at least two): A steel roof truss (riveted), a steel framed structure (welded), a plate girder, a water tank.

5. Preparation and submission of tenders (Group assignments)

6. **SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)**

Unit No.	Unit	Teaching hours/ Semester	Marks
1.	Elements of Estimation	02	03
2.	Estimation of Basic Cost in Machine Shop	12	12
3.	Estimation of Welding	06	06
4.	Estimation of sheet metal works	06	06
5.	Costing	16	06
6.	Equipment Replacement Policy	02	06
7.	Estimation of structural Steel work	12	15
8.	Contracts and Contract Documents	06	15
9.	Tender Notice	02	06
	Total	64 hours	75 marks

7. **LEARNING RESOURSES**

Sr. No.	Author	Title of Books	Publications
1.	B.S. Patil	Civil Engg. Contract and Estimation	Orient Lorgman
2.	O.P. Khanna	Mechanical Estimation & costing	DhanpatRai& sons
3.	Banga& Sharma	Mechanical Estimation & costing	Khanna Publishers, Delhi
4.	B.N. Datta	Estimation & Costing in Civil Engg.	UBS Publishers
5.	C. K. Singh M.I. Khan	Mechanical Estimation & Costing	------
6.	------	I.S. Codes 1200 part VIII	-------
7.	----	I.S. Codes 800-1964, 816-1978	--------
8.	S. Ramamruthan	Steel Tables	DhanpatRai& Company
9.	S.C. Rangwala	Estimation & costing	Charotar Publishing House
10.	Professional Practice	Dr.RoshanNamavati	Lakhani Book Depot
11.	TTTI Madras	Mechanical Estimation & costing	Tata Mcgraw Hill Publishing Company Ltd.
12.	V.K. Machanda	Mechanical Estimation & costing	Katson publishing House

(FE603) ERECTION ENGINEERING

1. RATIONALE – A technician engaged in structural erection and erection of machinery is required to possess a good knowledge of erection equipments and tools. He should have the required skill in the selection of methods. He is also responsible for directing the erection work and preventing accidents. The course on erection practice aims to develop in the students these abilities. It is suggested that the students should be involved in erection work during their industrial training periods, to supplement their knowledge gained in the institute.

2. **TEACHING AND EXAMINATION SCHEME**

Course code & Course Title	Periods/ weeks in hours			Total Credits	Examination Scheme				
					Theory Marks		Practical Marks		Total
FE603 Erection Engineering	L	T	P	7	TH	TM	TW	PR/OR	150
	3	-	4		75	25	25	25	

3. COURSE CONTENTS

1. ERECTION EQUIPMENTS 16 hrs 24 mks

Cranes: Definition of crane. Classification of cranes – based on construction, movement, load to be lifted & applications.Basic motions of cranes – hoisting, luffing & slewing.Factors to be considered for selection of cranes. Types of cranes: (i) Electric Overhead Travel crane. (ii) Mobile crane – Truck mounted, Rail mounted, Crawler Crane &self propelled wheel type crane. (iii) Traveller crane – brief description & applications. Difference between Mechanical cranes & Hydraulic cranes.Use of out riggers and counter weights in cranes.Safety precautions while working on cranes.

Derricks: Definition of derrick. Classification of derricks - (i) Guy derricks:- Important parts of guy derricks, brief description of construction, application. (ii) Stiff leg derrick – Important parts, brief description of construction, applications.

Other Erection Equipments (description & use) – Gin poles, shear legs.

2. ERECTION TOOLS & MATERIALS 12 hrs 18 mks

Manila ropes: Introduction. Brief description of construction.Materials & grades of manila ropes.Precaution in storage & handling.Inspection.Applications.

Wire ropes:Brief description of construction. Types of wire ropes – (i) Right –lay, regular-lay rope (ii) Left-lay, regular –lay rope (iii) Right-lay, Lang-Lay rope (iv) Left-Lay, Lang-Lay rope. Grades of steel used. Precaution in storage & handling.

Attachments:(a) Crosby clips (b) Thimble (c) Wedge sockets (d) Shakles& Hooks (e) spliced eye

Hoisting chain: Difference between hoisting chains & wire ropes.Precautions, Inspection.

Slings: Manila rope slings- limitations, Coil chains –applications, Wire rope slings-precautions. Types of slings – (i) Endless sling or grommet (ii) Choker sling (iii) Basket hitch (iv) Two leg sling (v) Double Basket sling (vi) Double choker sling (vii) Bridal sling (viii) synthetic –fibre sling.

Hand winch & Power winch.

3. HANDLING LOADS ON SLINGS 3 hrs 6 mks

Use of centre of gravity. Correct hook position. Use of Pads at sharp edges.Use of spreader bars. Precautions while handling loads on slings.

4. CHAIN HOIST 2hrs 3 mks

Types of chain hoists. Applications of each type of chain hoist.

5. JACKS, ROLLERS AND SKIDS 2 hrs 3 mks

Jacks: Types, Handling, Inspection. Rollers: Applications. Skids: Applications

6. ERECTION PROCEDURES AND TECHNIQUES 7 hrs 12 mks

Introduction.Preparatory work and important considerations.Precaution at erection site.Methods of erection, Leveling& Alignment, Allowable tolerances for plumbing, Erection of Tackle and false work. Erection by raising of gay derrick. Erection by using mobile crane.Method of erection of (a) Shed type building (b) Multi storey building. Protection of structures against corrosion.

7. CHECKING AND INSPECTION OF ERECTION WORK 3 hrs 3 mks

Introduction.Inspection and Rectification.Common defects. Guidelines to maintain quality in erection work.

8. SAFETY AND ERECTION HAZARDS 3 hrs 6 mks

Causes of accident – Direct causes, Indirect causes. Types of accidents during erection work. Accident prevention at erection site.Precautions while working at height.Safety rules while using Cranes, Winches & Pulley blocks. Safety using lifting appliances.Safety using slings.Safety for scaffolding.

4. TERMWORK:

1. Practice of various types of knots and hitches using Manila rope.
2. Rotating and resting a heavy rectangular block in its side on the ground, from its position on ends.
3. Hoisting and lowering a long plank by proper sling.
4. Hoisting a load (old machine) by proper sling and using shear legs.
5. Hoisting a load by Gin pole.
6. Industrial visit to study erection practice (Minimum 2 visits).
7. Practice on hoisting signals.

In addition, the students are required to maintain a journal, which should consist of the following:

1. Sketches of various knots and hitches.
2. Sketches of various slinging arrangements.
3. Sketches showing methods of erection for factory sheds, bridges and buildings with brief description of equipment used (list only) planning and procedure of erection.
4. Report of Industrial visits.

5. TEXT BOOKS:

1. Structural Steel Fabrication and Erection – By S.K. Saxena& R. B. Asthana
   Published by Somaiya Pub.Pvt. Ltd.

2. Hand book of Rigging- For construction & industrial operations – By W.E. Rossnagel
   Published by McGraw-Hill Book Co.

3. Crane Handbook – By D.E. Dickie
   Published by Butterworthe& Co. Ltd.

6. REFERENCE BOOKS:

1. Structural Steel Drafting and Detailing – By Shivagunde and Asthana
   Published by Somaiya Pub.Pvt. Ltd.
2. Handbook of Heavy Construction – By Havers and Stubbs
   Published by McGraw-Hill Book Co.
3. Building Construction Handbook – By F. S. Merit
   Published by McGraw-Hill Book Co.

(FE604) QUALITY CONTROL AND INSPECTION

1. RATIONALE:- A technician engaged in quality control and inspection department is required to have necessary cognitive abilities, skills and attitudes to perform his duties with professionalism and proficiency. This course is designed to develop those abilities and skills. The theoretical aspects covered in this course should be adequately supported and reinforced through discussions of case studies and properly structured laboratory experiences. A few of the practicals on testing, for which no laboratory facilities exist in this institute should be covered during industrial training or short visits to industry. The course also aims at developing the knowledge to execute the work to the required specifications.

2. **TEACHING AND EXAMINATION SCHEME**

Course code & Course Title	Periods/ weeks in hours			Total Credits	Examination Scheme				
					Theory Marks		Practical Marks		Total
FE604 Quality Control & Inspection	L	T	P	5	TH	TM	TW	PR/OR	150
	3	-	2		75	25	25	25	

3. COURSE CONTENTS Hrs. Mks.

1.**BASIC CONCEPTS OF QUALITY CONTROL** 6 6

Definition of quality as fitness for use, Quality characteristic, Parameters of fitness for use: a) quality of design b) quality of conformance c) abilities- i) availability ii) reliability iii) maintainability d) field service. Factors affecting quality of a product: a) market b) men c) money d) materials f) machines and methods g) miscellaneous.

Control:- Definition, Regulatory process of control. Quality control: Definition, Basic objectives, Advantages of quality control, Role of technician in promoting quality mindedness among workers and operators. Broad areas of applications of quality control: incoming materials control, process control, product control. Approach to solution of quality problems (Briefly): Engineering, Statistical Management.

2. **ECONOMIC OF QUALITY** 2 3

Quality value, Quality cost, Balance between quality cost and value, Categories of quality cost: prevention, appraisal, internal failure, external failure.

3. INSPECTION AND TESTING 8 12

Definition and Meaning, Difference between inspection and quality control, Aims of inspection: a) determining conformance to specifications b) planning c) procedure d) Training e) Calibration f) records g) standardization.

Classifications of inspection:- (i)based on work performance : a) Manual inspection b) Visual inspection c) Test inspection d) Automatic. (ii) Based on location: a) Process inspection b) Final inspection c) Receiving inspection d) Tool and Guage inspection. Duties of inspector: a) Interpretation of

specifications b) Measurement of product quality c) comparison with standards d) Disposition of the product e) Recording data. Inspection planning a) Necessity for planned inspection: b) What to inspect c) How to inspectd)when to inspect e) where to inspect f) how much to inspect. Tools of inspection: a) Specifications b) Inspecting equipment's c) inspection records d) sampling inspection.

4. **NON DESTRUCTIVE TESTING** 12 24

Visual Inspection, Acoustic test, Radiographic Testing: a) Introduction b) principle c) X-rays and γ-rays, d) x-ray radiography e) γ rays radiography f) penetrameters g) Interpretation of radiographs h) Pitfalls in interpretations i) Advantages and disadvantages of x-ray radiography j) Fluoroscopy, k) Advantages and disadvantages of γ radiography i) Safety precautions m) Applications. Magnetic Particle Testing : a) Basic principle b) Brief description of equipment c) Flaws detected d) Scope and limitations e) Sensitivity f) Dry and Wet methods g) Sequence of operations h) Irrelevant indications i) Common applications j) Inspection of light weldment, Penetrant Inspection: a) Principle of operation b) Types of penetrant inspection system c) Test procedure d) Inspection e) Common application f) advantages g) fluorescent penetrant inspection. Ultrasonic Inspections: a) Introduction b) Principle of operations c) Basic factors in Ultrasonic testing d) Testing technique e) Techniques selection f) Evaluation g) Applications, Advantages and Limitations. Eddy Current Testing: a) Principle of operation b) Testing of non magnetic materials c) Testing of magnetic materials d) Advantages and Limitations e) Applications . Leakage Testing: a) definition b) measurement of leakage c) Types of leaks d) Types of tests i) Visual test ii) Testing under fluid pressure iii) Leakage detecting by gas iv) Water soluble paper with aluminium foil.

5. DESTRUCTIVE TESTING 6 12

Tensile Test a) Preparation of specimen b) Test procedure c) Test report d) Longitudinal tensile test. Compression Test: a) Principle of compression test. b) Information gained c) Practical reasons for test d) Test piece e) Practical aspects of test. Bend test: a) Introduction b) Types of bend tests c) Free bend test d) Guided bend test e) Longitudinal bend test f) Side bend test. Impact test a) Principle of test b) Types of tests) Charpy V-notes Impact test ii) Izod V-notes Impact Test c) Test procedure d) Reporting of result. Etch Test: a) Introduction b) concept and purpose c) types of Tests i) Micro –etch test ii) Macro-etch test d) Preparation of test specimen. Nick Break Test: a) Purpose b) Preparation of specimen c) Test procedure. Hardness test: a) Purpose of test b) Types of Tests c) Procedure of testing.

6.INSPECTION OF PRESSURE VESSELS AND PIPES 5 6

Various codes : a) A.S.M.E. b) A.S.T.M. c) D.I.N. d) I.B.R. e) Loyds Register of shipping f) G.S.T. Use of I.B.R. in Brief.

7. SPECIFICATIONS 4 6

Definition, Purpose of specification, Types: a) Contract specification b) Manufacturers specification c) Standard specification. General principle of writing specifications, Sources of information for specification: a) Previous specification b) Contract specification c) Site investigations d) Employers

requirements e) I.S. codes/ I.B.R. code

8. **MODERN TOOLS & TECHNIQUES FOR QUALITY ASSURANCE**	5	6
TQM, ISO 9000, 5S,Quality Circle, Zero defect, 6 sigma, Kaizen		
TOTAL	48	75

4. TERM WORK

The term work shall consist of any 8 of the following laboratory tests and maintenance of laboratory reports following:

Study of different defects in welded joints.

Visual Inspection & Sound Test

Dye penetrant test.

Fluorescent penetrant test

Magnetic particle test

Magnaflux testing of welds

Tensile tests on welded specimens (Welded by MMAW, GMAW and Gas Welding)

Bend tests on welded specimen

Impact tests on welded specimen

5. TEXT BOOKS

1. A text-book of Welding Technology by Dr. O. P. Khanna, DhanpatRai& Sons, Delhi
2. Quality Planning & Analysis by J. M. Juran& F. M. Gryna, TATA McGraw-Hill Pub.

6. REFERENCE BOOKS

1. Engineering Metrology by R. K. Jain, Khanna Pub
2. Inspection & Quality Control by M. V. V. Raman, National Productivity Council
3. Metals Handbook, ASM, Vol 6

(FE605) FABRICATION WORKSHOP PRACTICE

1. RATIONALE:- The syllabus of this subject is so designed that the students are given practical skill to actually perform the different operations which are encountered in the fabrication field. The syllabus is designed to have three stages. The first stage students have to do jobs individually in which they will acquire individual working skills. In the second stage the students have to do job in a group where they will learn about team work. The third stage is to undertake an assignment where this group shall be performing fabrication, repair or maintenance work in the form of minor project.

2. **TEACHING AND EXAMINATION SCHEME**

Course code & Course Title	Periods/ weeks in hours			Total Credits	Examination Scheme				
					Theory Marks		Practical Marks		Total
FE605 Fabrication Workshop Practice	L	T	P	4	TH	TM	TW	PR/OR	100
	-	-	4		-	-	50	50	

Objective:- The experience gained during the industrial training can be properly delivered in this subject. This subject is so aimed to give the students practical skills required to develop self confidence to work individually or in a group. It will also motivate them to build up entrepreneurship skills and prepare them to undertake major work as Fabrication Project in next semester.

Students are required to perform the following experiments:

1. Practicing drilling of holes in a structure and fixing a blind and solid rivet.
2. Study of manual rod bending table and bending tool and practice to bend round bars and square bars, using the bending tool on the table.
3. Bending round bars of size 10mm dia and square bars of size 10mm to form different shapes like small rings, S- shape, C- shape (atleast two different shapes per student) to the required dimensions.
4. Marking an angle of size 25mm x 25mm x 3.0mm and cut and bend the corners to form an angle frame to the required dimensions.
5. Rolling a plate to form a cylinder on 3- roll plate bending machine.
6. Making end templates of pipe for the above bend in order to fabricate a 3 piece pipe bend by cutting and welding pipe of size 60mm dia.
7. Bending manually an angle to form a ring with the flange leg outside and/or inside.
8. Fabricating Aluminum structure like a window frame with aluminum extrusions with the help of self tapping screws.

In a group of maximum 4 students

9. Fabricating a small table of angles and flats.

10. Fabricating a stool of angles and bars.
11. Fabricating trapezoidal dust bins from 1mm sheet metal and joints made of rivets.
12. Twisting a 10mm square bar with a bar twisting tool and vice.

Assignments / Minor projects

13. Fabricating a structure like grills of different design of interior members.
14. Repair or Maintenance of any steel structure in the institution premises.

REFERENCE BOOKS:

1. Basic Fabrication and Welding Engineer by Smith, F. J. M. Longman
2. Technician Fabrication and Welding by Cooper K. J. Greenwood (Cassel Series)
3. Elements of Mechanical Engg by K. P. Roy & S. K. HajraChoudhury, Media Promoters & Pub.

(CS601) INDUSTRIAL ORGANISATION AND MANAGEMENT

1. RATIONALE

When a diploma pass out will start working in the wok place in any office or shop floor, he /she has to perform work or get work done from subordinates on day to day basis as well as for ongoing week or month. This performance has to be very efficient and effective in order to achieve the set goals. The work performance demands proper manaegement of all kinds of resources (money, material, men, machines, methods, time) for achievement of goals. This management has a science part as techniques of planning, organising, directing &controling. It has an art part, how well these techniques are applied to get the desired results. The student should have a good knowledge of art & science of management, so that he is able to motivate himself & others to work.

2. TEACHING AND EXAMINATION SCHEME

Course Code & Course Title	Periods/ Week (In Hours)			Total Credits	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
CS601	**L**	**T**	**P**	**C**	**TH**	**TM**	**PR/OR**	**TW**	
Industrial Organisation and Management	3	-	-	3	75	25	-	-	**100**

Minimum passing % : Theory 40% and Practical 40% *Duration of Theory Paper: 3 Hrs.*

3. COMPETENCY TO BE DEVELOPED THROUGH THIS COURSE

The course content should be taught and implemented with the aim to develop different types of skills leading to the achievement of the competency **– *' Use principles of industrial management in production, operation & maintenance of mechanical components & systems'.***

4. DETAILED COURSE CONTENT

Unit 1 Business Organisation

Types of business organizations: Individual Proprietorship Organisation, partnership organization, Joint Stock Companies : Private Ltd and Public Ltd , Co-operative societies, Public sector Organisation

Structure of business organization: Line Organisation, Functional Organisation , Line and staff Organisation, Project organization

Unit 2 Business Management

Functions of management: Concept of management and administration, management as an art and science, evolution and growth of scientific management- contribution of F.W Taylor, management functions such as forecasting, planning, organizing, directing, communicating, controlling, co-ordinating, motivating, guiding, counseling and decision- making.

Functions in Industry: Procuring, store- keeping, inventory control, material handling, manufacturing or production, supervision, quality assurance, packing and forwarding, marketing- sales promotion, research and development, supervisory skills. Introduction to ISO.

Unit 3 Financial Analysis

Finance: Introduction, sources of finance, important financial statement such as profit and loss, balance sheet and cash flow.

Cost Concepts: Introduction, necessity of costing, elements of cost- direct and in direct, variable and fixed, prime cost, overhead cost, total cost, marginal costing, break- even chart analysis, angle of Incidence.

Materials management: Economic Order quantity, reordering system, base stock and lead time, inventory valuation , ABC Analysis

Definition of Budget and Budgetory control

Depreciation: Methods of calculating depreciation charges : Straight Line Method , Sinking Fund Method, Diminishing Balance Method.

Obsolescence- definitions and reasons.

Unit 3 Personnel Management

Functions of Personnel Department: Human resource Planning, selection and recruitment, training and placement, promotion and transfer, motivation and morale of workers, welfare of employees.

Industrial Relations: Relations with Individual worker, relations with unions, relations with government, settlement of disputes of employees, collective bargaining, conciliation, arbitration, grievance handling mechanism, domestic inquiry.

Wages and Incentives: Types of wage plans – Time rate and piece rate, characters of good wage plan, incentive – objectives and advantages, character of good incentive plan, individual and group, incentive plan, difference between incentive and wage.

Unit 4 ***Industrial Acts and Taxes***

Introduction to Following Industrial Acts:
Industrial Disputes Act 1947/1956;
The Indian Factories Act 1948
The Workmens Compensation Act 1923;
Introduction to sales tax, Custom and excise duty , VAT.
Unit 5 ***Project Management : Network Analysis***
(Introduction to basic concepts with simple problems)
PERT- Programme Evaluation and Review Technique: Definition, network diagrams, advantages.
CPM- Critical Path Method: Definition, finding critical Path, advantages, Comparison of PERT and CPM.

5. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)

Unit No.	Topic	Minimum Teaching Hours per Semester	Total Marks
1	Business Organisation	**6**	**9**
2	Business Management	**10**	**15**
3	Financial Analysis	**13**	**21**
4	Personnel Management	**10**	**15**
5	***Industrial Acts and Taxes***	**4**	**6**
6	***Project Management*** ***Network Analysis***	**5**	**9**
	Total	**48**	**75**

6. SUGGESTED LEARNING RESOURCES

S.No.	Author	Title of Books	Publication & Year
1	T R Banga , S.C. Sharma	Industrial organization & Engineering Economics	Khanna Publishers Latest
2	O.P. Khanna	Industrial engineering & management	Khanna Publishers
3	Awate, Chunawala, Bhandarkar, Shrinivasan	Industruial Organisation & Management	Latest
4	M.C. Shukla	Bussines Organisation & management	Latest
5	M. Mahajan	Industrial Engineering & Production Management	DhanpatRai& co.
6	O.P. Khanna	Industrial engineering & management	Khanna Publishers
7	Satya saran Chatterji	Modern Business- Organisation & Management	Latest

Semester :- VII

Course code	Name of Course	TEACHING SCHEME				EXAMINATION SCHEME				Total marks
		L	T	P	C	Theory marks		Practical marks		
						TH	TM	PR/ OR	TW	
FE701	Design of Steel Structures	4	-	4	8	75	25	25	25	150
FE702	Theory of Structures(A)-II	4	-	1	5	75	25	-	25	125
FE703	Fabrication of Boilers and Pressure Vessels	3	-	2	5	75	25	25	25	150
FE704	Fabrication Project	-	-	4	4	-	-	50	50	100
CS501	Entrepreneurship Development	-	-	2	2	-	-	-	50	50
E2	Elective II	3	-	2	5	75	25	25	25	150
IE6**	Institutional Elective	3	-	2	5	75	25	25	25	150
	Total	**14**	**-**	**15**	**29**	**400**		**325**		**725**

Elective II
FE611 Piping Fabrication & Installation
FE613 Surface Treatment & Corrosion Prevention.
FE614 Off- Shore Structures.
FE615 Hydraulic & Fluid Mechanics
FE616 Repair and Maintenance Welding
ME615 Renewable Energy Sources
ME617 Modern Marketing Management
ME618 Safety Engg
IE6** Institutional Elective

Semester: - VIII

Course code	Name of Course	EXAMINATION SCHEME				Total
		TW		PR/OR		
		Daily Diary	Progressive Assessment	Training Report	Report Assessment & Seminar/Viva	
FE801	Fabrication Inplant Training -II	**50**	**50**	**50**	**50**	**Grade**

FOR INDUSTRIAL TRAINING OF VTH& VIIITH SEMESTER:

4. Grades will be awarded based on marks scored as follows:
    e. 80% and above Marks – Grade 'A'
    f. 60% to 79% Marks – Grade 'B'
    g. 40% to 59% Marks – Grade 'C'
    h. Marks below 40% - Grade 'D'

5. TW and PR/OR shall be separate Heads of passing. Student has to secure minimum Grade 'C' for passing.

6. Student with Grade D under the Head TW, shall be declared T.N.G. and a student whose term is granted but obtains Grade D under the head PR/OR, shall be declared Failed/ATKT.

SEMESTER VII

(FE701) DESIGN OF STEEL STRUCTURES

1. Rationale: With the rapid industrial growth and development in transportation system, the construction of complicated industrial structures, railway bridges and stations, airport hangers, transmission towers became imperative. Steel with proven quality, lightweight sections, ease and speed of fabrication became most appreciated structural material. The course content has been designed to enable the students to acquire the knowledge of fundamental principles of steel structures and relevant Indian Standard codes of practice for design and detailing of steel structures.

2. Teaching and Examination scheme

Course Code & Course Title	Periods/ weeks in Hours			Total Credits	Examination Scheme				
					Theory marks		Practical marks		Total marks
FE701 Design of Steel Structures	L	T	P	C	TH	TM	PR/OR	TW	
	4	-	4	8	75	25	25	25	150

3. COURSE CONTENTS.

1.STEEL STRUCTURES

Properties of structural steel- Mild steel and high tensile steel. Fields of applications of steel structures. Advantages and disadvantages of steel structures.

Analysis of loads - dead load, live load, wind load, seismic load and other secondary load , as per I.S 875-1987.

Different structural steel shapes- their properties and applications.

Use of I.S. Handbook for structural Engineers and Steel Tables.

2. BOLTED AND WELDED CONNECTIONS

Types of Bolts, Permissible stresses in bolts, Advantages and Disadvantages of bolts, Bolts of uniform strength. High strength bolts

Design of Axially loaded bolts, Design of Eccentrically loaded bolts with moments in the plane and perpendicular the plane of the bolts.

Types of weld, weld size, throat thickness, effective length, overlap of weld, weld symbols, permissible stresses in welds, recommended size of weld as per I.S. 816

Strength of welded joint, determination of weld length, minimum length of weld for Axially loaded welded joints

Design of Eccentrically loaded welded joints subjected to moments in the plane and perpendicular to the plane of the welds.

3. TENSION MEMBERS

Sections used as tension members under axially loading, single and built-up sections,

Net sectional area for angles, Tees and channels, permissible stresses in Tension and computation of safe load. Design of a tension member for a given load along with Welded end connection.

4. COMPRESSION MEMBERS.

Section used as compression members under axial loading, Single and Built-up sections, Effective length and least radius of gyration, effective length for different end conditions for column and Continuous and Discontinuous single angle and double angle struts.

Maximum slenderness ratio as per I.S. 800-1984, Permissible stresses in compression and determination of safe load.

Design of Compression member for the given load using specified section along with welded connection.

Necessity of lateral supporting system for built-up column by single and double lacing and Battens(No numerical Problems on Design of Lacing and Battens)

Design of Column Bases-Slab based and Gussetted bases with plain concrete pedestal.

5.BEAMS.

Sections suitable for beams – single and built-up sections. Factors governing the design of Beams-bending moment, shear force, deflection, web buckling and web crippling.

Laterally supported beams and types of lateral restraint, permissible stresses in bending and shear, limiting deflection.

Design of laterally restrained simply supported beam.

Concept of beam to beam and beam to column connection (No design on connections)

Introduction to plate girders, components and applications.

6. ROOF TRUSSES

Type of steel roof trusses used for different spans, pitch and span of trusses, spacing of purlins, necessity of bracing. Analysis of roof truss for dead load, live load and wind load, calculation of panel point loads. Methods of joints and computation of design loads. Design of tension and compression members- continuous and discontinuous and design of welds.

Design of purlins and connections.Design of base plate at support.Provision of sliding joint, concrete bed block and holding down bolts. Trusses with tubular and box sections-advantages and disadvantages.

4. TERM WORK

1) Termwork shall consist of sketchbook and elementary design of the structural components.
2) Emphasis should be given on using I.S. Handbook and relevant I.S. codes
3) Sketch book shall comprise of the following items:-
   - Different Structural steel sections and their properties.
   - Different types of compression members and tension members.
   - Design and drawing of tension member of different types with welded end connection and bolted connection.
   - Design and drawing of compression member of different types with welded end connection.
   - Single and double Lacing system for compression members
   - Column bases – design and drawing of slab base and gusseted base for I section column and stanchion.
   - Built –up beam with welded connection.
   - Sketch of beam to beam and beam to column framed connection and seated connection.
   - Welded and Rivetted plate girders(only detailing and no design)

4. Two imperial size sheets with report of calculations on Design and detailing of steel roof truss, connection of column to truss and column to base foundation. Fixing of purlins to truss members.

5. SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)

Unit No.	Unit	Teaching hours/ Semester	Marks
1.	STEEL STRUCTURES	3	6
2.	BOLTED AND WELDED CONNECTION	10	15
3.	TENSION MEMBERS	7	12
4.	COMPRESSION MEMBERS.	8	14
5.	BEAMS.	10	14
6.	ROOF TRUSSES	10	14
		48 hrs	75 marks

6. LEARNING RESOURSES

Sr. No.	Author	Title of Books	Publications
1.	S.K. Duggal	Design of Steel Structures	Tata McGraw Hill Publishing Co. Ltd.- 1993
2.	Aarya A.S. J.L. Ajwani	Design of Steel Structures	Nemchand& Brothers, Roorkee-1989
3.	Dr.Ramchandra	Design of Steel Structures Vol-I	Standard book House Delhi- 1986
4.	P. Dayaratnam	Design of Steel Structures	Wheeler-1990
5	N.C. Sinha	Fundamentals of Reinforced Cement concrete	S. Chand & Company Ltd. Delhi.-1986
6		Code of Practice for General construction in Steel	Indian Standard Institution, New Delhi-11302
7		(Part1 to Part 4) Code of Practice for design loads for building and structures	Indian Standard Institution, New Delhi-11302
8.	S. Ramamrutham	Steel tables	DhanpatRai& Sons, New Delhi

(FE702) THEROY OF STRUCTURES(A)-II

1. **RATIONALE**: This course is continuation of Theory of Structures-I, the topics included are of relatively advanced in nature to enable the student to analyse the given structure, developing cognitive abilities and skills of high level.

2. TEACHING AND EXAMINATION SCHEME

Course Code & Course Title	Periods/ weeks in Hours			Total Credits	Examination Scheme				
					Theory marks		Practical marks		Total marks
FE702 Theory of Structures(A)-II	L	T	P	C	TH	TM	PR/OR	TW	
	4	-	1	5	75	25	--	25	125

3. COURSE CONTENT

1. SLOPE AND DEFLECTION

Concept of slope and deflection. Concept of deflected shape of simply supported beam , cantilever beam, continuous beams and portal frame subjected to point loads and uniformly distributed load over the entire span. (No numerical example). Deflections for standard cases- using Moment Area Method (Mohr's Theorems). Propped cantilevers, only basic concepts, simple problems, prop-reaction, B.M.D. and S.F.D.

2. FIXED BEAMS OF UNIFORM SECTIONS

Determination of fixed end moments for the beams carrying point loads and uniformly distributed load.on full and part span. construction of shear force and bending moment diagrams.

3.MOMENT DISTRIBUTION METHOD

Definition of Stiffness, relative stiffness distribution factor, carry-over factor. Sign conventions. Analysis of continuous beam of uniform section, supports at the same level and carrying point load and uniformly distributed load over entire spans. Analyse of simple portal frame of uniform section and support at the same level subjected to point loads and uniformly distributed load over the entire span(only non- sway analysis).

4. COLUMNS

Types of column, definition, short and long column.Buckling of long columns under axial loading. Euler's formula for cripping-load (derivation not needed). End-conditions, effective length, slenderness ratio.Limitaitons of Euler's formula.Rankine's formula. Column formula as per I.S. 800-1984

5. THREE HINGED ARCHES

Three hinged arches. Horizontal thrust. Types of arches- circular and parabolic arches with supports at same level and at different levels subjected to concentrated loads, uniformly distributed load. Problems on analysis of arches with supports at same and at different levels for horizontal thrust, Normal reaction and radial shear.

4. SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)

Unit No.	Unit	Teaching hours/ Semester	Marks
1.	SLOPE AND DEFLECTION	**10**	**16**
2.	FIXED BEAMS OF UNIFORM SECTIONS	10	16
3.	MOMENT DISTRIBUTION METHOD	12	19
4.	COLUMNS	8	12
5.	THREE HINGED ARCHES	8	12
		48 hrs	75 marks

5. TERM WORK

1) Practice on problems of determination of slope & deflection for cantilever and simply supported beams.
2) To plot SF & BM diagrams for fixed beams.
3) To plot SF & BM diagrams for continuous beams of 2 spans & 3 spans for portal frame of symmetrical structures without sway.
4) Practice on problems of determination of critical load of uniform section and built up section by various methods.
5) Practice on determination of reactions, bending moments & radial shear of 3 hinged parabolic arch.

6. LEARNING RESOURSES

Sr. No.	Author	Title of Books	Publications
1.	S. Ramamrnthan	Strength of Materials	DhanpatRai& Sons, New Delhi
2.	Vazirani&Ratwani	Analysis of Structures	Khanna Publishers New Delhi
3.	Dr. Sadhu Singh	Strength of materials	Khanna Publishers New Delhi
4.	S.S. Bhavikatti	Strength of materials	Vikas Publishing House Pvt. Ltd. Noida (UP)
5	R.S. Khurmi	Analysis of Structures	S. Chand & Company Ltd. Delhi.
6	S.P.Timoshenko	Theory of Structures	McGraw Hill
7	R.S. Biyani	Theory of Structures	VrindaPublicaiton , Jalgao
8.	S.B. Junnarkar	Mechanics of Structure Vol -I	Khanna Publishers New Delhi
9.	O.P Jain & B.K. Jain	Theory and Analysis of Structures	Khanna Publishers New Delhi

(FE703) FABRICATION OF BOILERS & PRESSURE VESSELS

1.RATIONALE: Boilers and Pressure vessels are used extensively in industries either as process or power generation equipments and therefore find an important place in industries. This course is intended to orient the fabrication technician to the design and fabrication of boilers and pressure vessels. Basically the course is divided in two parts, one part consist of the study of different fabrication processes involved to process the material for fabrication of boilers and pressure vessels like Roll bending, Bending and Forming of plates & tubes and spinning. The other part consists of Stress analysis, Design, Inspection & Testing and Failure analysis of boilers and pressure vessels.

2.TEACHING AND EXAMINATION SCHEME

Course Code & Course Title	Periods/ weeks in Hours			Total Credits	Examination Scheme				
					Theory marks		Practical marks		Total marks
	L	T	P	C	TH	TM	PR/ OR	TW	
FE703 Fabrication of Boilers & Pressure Vessels	3	-	2	5	75	25	25	25	150

3.DETAILED COURSE CONTENT: **Hrs** **Mks**

1. PRESS WORK 3 6

Types of Presses: (i) Hand operated - Fly press, (ii) Power operated – Mechanical and Hydraulic, Types of Power Presses:- Gap –Frame Presses, Straight- side presses. Press operations (brief description) – Blanking, Piercing, Notching, Forming , Trimming. Flanging, Drawing, Lancing, Embossing, Re-striking, Flattening.

2. BENDING & PRESS – BREAKING 7 10

Bending :- Mechanicsm of Bending, Spring back method to compensate for spring back, Basic bending methods, Bending Allowances, Centre line bend allowance, Precision bend allowances. Bending Machines:- Press Brake, Universal folding machine, Hydroform folding machine.

Press Breaking:- Principle of press brake, Types of press brakes – Mechanical and Hydraulic,Press braking tools- Four way die, Acute angle tool, Goose neck punches, Radius bending punches, Flattering die punch set, Forming die punch set. Press Brake operation- Producing structural sections like angles channels, Z-sections, hot sections and complex sections etc. and sequence of bend in each. Limitations of Press Breaking, Safety. Bending of

structural members - Forming the frame, Forming an external angle ring, Angle ring bending rolls.

3. ROLL BENDING 4 6

Introduction, Shapes produced, Metal thickness, Diameter and Width, Roll bending Machine: (i) Pinch type and (ii) Pyramid type, Pinch type rolls - Roll-up, Roll-down type, Three-rol type, Four- roll type. Pyramid type - Three roll type, Three rolls with adjustable bottom rollers. Vertical plate bending machine.Rolling of trancated cone. Slip rolls. Safety in roll bending.

4.BENDING AND FORMING OF TUBING 6 10

Principle of bending, Selection of bending methods- hand v/s power bending, form block, clamping blocks, pressure dies, wiper dies, mandrels, loose fillers, dies formed rolls. Bending tubing with a mandrel – Plug and Formed mandrels, Ball mandrels, Dimensional accuracy.Bending tubing without mandrel. Machines: Powered rotary benders, bending presses, roll benders. Hot bending- localised heating for compression bend. Bending thin wall tubes - machines, tools, materials. Production Ex. Lubricaton for tube bending.

5. SPINNING 3 5

Introduction to metal spinning, Spinning lathes, Spinning process- Hand spinning. Hand forming tools for metal spinning, lubrication for spinning, Spindle speeds for spinning.

6. STIFFENING AND STRENGTHENING 4 6

Reasons for Stiffening, Basic principle of stiffening, Methods of imparting stiffness to sheet metal- Single fold, Double return fold, Dished ends, Single lem, Lightening holes, Wiring, Swaging, Embossing, Use of stiffeners, Profile sheet, Methods of Stiffening large panels - Use of applied stiffeners, Use of angle stiffeners, Stiffening of containers and tanks. Strengthening at stress concentration areas.

7. SELECTION OF CONSTRUCTION MATERIALS 3 6

General Consideration, Non- corrosive service, Corrosive service, Bolting materials, Stainless steel, Selection of steel for hydrogen service, Aluminium alloys.

8. DESIGN OF PRESSURE VESSELS 12 15

Introduction, Design pressure, Design temperature, Dead loads, Wind loads, Piping loads, Earthquake loads and Combination of design load. Stresses in cylindrical shells (thick and thin), Stresses in spherical shells (thick and thin), Discontinuity stresses in vessels, Stresses in bimetallic joints, Thermal stresses.

9. PRESSURE VESSELS FAILURES 2 5

Corrosion failure, Stress failure, Design precautions, Buckling of P.V. under external load, Fatigue failure, Brittle facture.

10. INSPECTIONS AND TESTING AS PER IBR, ASME 4 6

Inspection during construction prior to welding, during welding.Hydraulic test, Vaccum test, their importance during construction.Hydro test and procedure. Radiography, condition required radiographs, interpretation of welding radiographs.

Total **48** **75**

TERM WORK

1. Fabricating sections likes angles, channels, Z- section etc. from M.S. sheets by bending.
2. Fabrication a cylinder/truncated cone of M.S. sheets
3. Preparing hole profile for header pipe and end profile of branch pipe and then fabricating pipe intersection joints by welding
4. Fabricating pipe bends by cutting and welding.
5. 2 Industrial visits for observing the operation of boilers and pressure vessels .

REFERENCE BOOKS

1. Basic Fabrication and Welding Engg. By F. J. M. Smith , Longman.
2. Technician Fabrication and Welding , by K.J. Cooper and T.P. Greenwood, Cassels TEC Series.
3. Metals Handbook- volume 4(Eigth Edition) – Forming, American Society for metal.
4. Development for P.V Tech-I , by R.W. Nichols.
5. Pressure Vessels – ASME code Book Welding, Welding procedure, chapter 6 pa 15.
6. Modern Pressure Vessels , by John F. Harvey.
7. Pressure Vessel Engg. Technology by R.W. Nichols
8. Pressure Vessels Design Handbook by Henry H. Bednar.

(FE704) FABRICATION PROJECT

1. RATIONALE:- The student centred activity is aimed at providing a closer co-ordination and integration of theory and practice to effect a more practical bias to the abilities to be acquired by the students. The project work enables the student to recognize and appreciate the relevance and importance of each subject learnt so far and at the same time it provides them opportunity to integrate, organize and apply their knowledge and skill to produce something which is perceivable. The project work, if properly designed and undertaken, helps in achieving higher level cognitive skills and attitudes which often difficult to accomplish through the usual teaching in class room constrained activities. Besides, it builds confidence of accomplishment in the student.

2.TEACHING AND EXAMINATION SCHEME

Course code & Course Title	Periods/ weeks in hours			Total Credits	Examination Scheme				
					Theory Marks		Practical Marks		Total
FE704 Fabrication Project	L	T	P	4	TH	TM	TW	PR/OR	100
	-	-	4		-	-	50	50	

Objectives:- The Project should be such that it would enable the student to Demonstrate self-reliance and self discipline; Understand and accept his own strengths and weakness; Work independently; Develop skills in decision making; Develop skills in seeking and selecting necessary information; Develop attitudes of working in a group; Demonstrate initiative; Demonstrate sensitivity to the changes in environment; Apply knowledge; Analyses, synthesis and evaluate; Develop social skills; provide evidence of creativity.

1. GROUP FORMATION & IDENTIFICATION OF PROJECT	2 to 5 students per group should identify the project
2. PROJECT PLAN	Initial brief report with probable design drawing & BOM
3. APPROVAL	Getting the plan approved from guide/HOD
4. DESIGNING & ANALYSIS	Detailed plan of action involving Design calculations, material & Process selection, Operational procedure etc.
5. PROCUREMENT OF RESOURCES	Purchase of material by sponsorer of project
6. FABRICATION	Fabricating the structure in the department workshop

7. ERECTION/INSTALLATION	Placing the structure in its respective location for usage

EVALUATION SCHEME

The progressive assessment marks (50) will be divided as under:

Daily Diary	25 marks

(Equal weightage should be given to all objectives mentioned above)

Seminar	25 marks
Total	50 marks

The practical examination marks (50) will divided as under:

Project Report	30 marks
Oral examination	20 marks
Total	50 marks

(CS501) ENTREPRENEURSHIP DEVELOPMENT

1. RATIONALE

The course on Entrepreneurship Development focuses on creating awareness regarding entrepreneurial traits, entrepreneurial support system, opportunity identification, project report preparation and understanding of legal and managerial aspects related to setting up of enterprise. This can be helpful in motivating technical students to start their own small-scale business/enterprise.

2. TEACHING AND EXAMINATION SCHEME

Course Code & Course Title	Periods/ Week (In Hours)			Total Credits	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
CS 501Entrepreneurship Development	L	T	P	C	-	-	PR/OR	TW	50
	-	-	2	2	-	-	-	50	

Minimum passing % Practical 40%

3. COMPETENCY TO BE DEVELOPED THROUGH THIS COURSE

The course content should be taught and implemented with the aim to develop different types of skills leading to the achievement of the competency – ***Prepare a detailed project report for an identified product/service.***

4. DETAILED COURSE CONTENT

Unit 1:Introduction (7 Hours, 12 Marks)

Meaning of entrepreneurship, need in the present scenario, definition of an entrepreneurship, qualities of an entrepreneur, functions of an entrepreneur, risks and rewards of entrepreneurship.

Definition of Micro, Small And Medium Enterprises (MSME).Classification of Micro, Small And Medium Enterprises (MSME). Types of Enterprises - manufacturing, service and franchisee.

Unit 2:Forms of Business Organisation (2 Hours, 9 Marks)

Main features of Sole Proprietorship, Partnership, Private Limited Company, Public Limited Company, Co-operative Society.

Unit 3:Entrepreneurial Support System (6 Hours, 9 Marks)

Central Government Agencies: Functions of Small Industries Development Bank of India(SIDBI), National Bank for Agriculture and Rural Development (NABARD), National Small Industries Corporation (NSIC), Micro, Small And Medium Enterprises -Development Institute (MSME- DI), Technology Business Incubator (TBI), Khadi& Village Industries Commission (KVIC).

State Government Agencies: Functions of District Industries Centre(DIC), Goa Industries Development Corporation (GIDC), Economic Development Corporation (EDC), Financial Institutions-Banks, Goa Handicrafts and Rural Small Scale Industries Development Corporation (GHRSSIDC), Rural Development Agency (RDA), Khadi and Village Industries Board (KVIB).

Unit 4: Business Opportunity Identification(7 Hours, 6 Marks)

Evaluation of business opportunity:- selection of industry, initial prospects study, product marketing concept, decision to proceed, feasibility study, project evaluation.

Unit 5: Market Research (6 Hours, 12 Marks)

Definition of demand, factors affecting demand, law of demand,demand curves

Definition of supply, factors affecting supply,law of supply, supply curves.

Preparation of questionnaire. Data collection for setting up a small enterprise.

Unit 6: Legal Aspects (4 Hours, 9 Marks)

Procedure of registration of Micro, Small And Medium Enterprise (MSME), meaning and registration of Value Added Tax(VAT), Service Tax, PAN. Slabs of Income tax.

Unit 7: Project Report (16 Hours, 18 Marks)

Need for project report, importance of Project report,

scope of project report:Economic aspects, technical aspects,financial aspects, managerial aspects, production aspects.

List the contents of a project report.

Proforma of a project report which includes:-Introduction,scheme, profitability and projections, infrastructure, break- even point, names and addresses of suppliers, remarks.

Project Profile.

Project appraisal criteria:- technical feasibility, financial feasibility, economic viability, commercial viability, managerial competency, political and labour considerations.

4. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)

Unit No.	Topic	Teaching Hours/ Semester	MARKS
1	Introduction	7	12
2	Forms of Business Organisation	2	9
3	Entrepreneurial Support System	6	9
4	Business Opportunity Identification	7	6
5	Market Research	6	12
6	Legal Aspects	4	9
7	Project Report	16	18
TOTAL		**48**	**75**

5.MANDATORY ASSIGNMENTS

1. Preparation of a Case Study on leading entrepreneurs of Goa. (To be taken while conducting Unit 1)
2. Preparation of a Case Study on leading entrepreneurs of India. (To be taken while conducting Unit 1) Unit 1)
3. Filling of template of “Business Model Canvas”
4. Prepartion of Project Profile.
5. Preparation of Project Report.

6.SUGGESTED ACTIVITIES:

1. Visits to related departments (DIC,Banks,Tecnology Business Incubators, MSME-DI, NSIC, KVIC, KVIB).
2. Study visits to industries.
3. Organise entrepreneurship related event / activities.
4. Organise lectures/seminars with successful entrepreneurs.
5. Organise brainstorming sessions on ideation.
6. Establish an Entrepreneurship Development Cell.

7. SUGGESTED LEARNING RESOURCES

S.No.	Author	Title of Books	Year of Publication
1.	*Sharadjawadekar, shobhadodlani,*	*Business entrepreneurship*	*Suvicharprakashanmandalpune,*
2.	*S.S. Khanna*	*Entrepreneurship development*	*S. Chand & Co. Ltd, New Delhi,*
3.	*Vasant Desai*	*Management of small Scale Industry in India*	*Himalaya Publishing House*
4.	*DilipSarwate*	*Entrepreneurial development Concepts and practices*	*Everest Publication House, Pune*
5.	*CB Gupta and P Srinivasan*	*Entrepreneurship Development*	*S. Chand and Sons,* *New Delhi*
6.	*PM Bhandari*	*Handbook of Small Scale Industry*	

(FE611) PIPING FABRICATION AND INSTALLATION

1. **RATIONALE**: Modern industries without pipelines would be handicapped in their performance. Therefore the course in Piping Fabrication and Installation is aimed to equip the students with knowledge and skill to fabricate pipelines. This course therefore includes piping design, piping materials and components, piping drawings and fabrication, essentially required to erect a pipeline. Other considerations like pipeline inspection and testing, piping insulations and special design considerations are also given due importance.

2.TEACHING AND EXAMINATION SCHEME:

Course Code & Course Title	Periods/ weeks in Hours			Total Credits	Examination Scheme				
					Theory marks		Practical marks		Total marks
	L	T	P	C	TH	TM	PR/OR	TW	
FE611 Piping Fabrication & Installation	3	-	2	5	75	25	25	25	150

3. COURSE CONTENTS:

	Hrs.	Mks.
1. INTRODUCTION Type of Pipelines - Process piping & Cross-country pipelines, Piping specification - Type of Materials, Nominal Bore (N.B), Class/Grade, Schedule of Pipe. Major Phases in Piping Installation-PFD, P&ID, and Equipment plot Plan, Nozzle Schedule, Piping Plot Plan, Piping Isometric.	3	6
2. PIPE MANUFACTURE Types of Pipes: Seam Pipes – (i) ERW (Electric Resistance welded) pipes – rolling a strips resistance weld the seam. (ii) Roll Welding- Transverse rolling of plates and welding of joints by any welding process. Seamless pipes- Hot rolling, Extrusion	4	6
3. PIPING MATERIALS SELECTION Types of Pipe Materials: Metallic & Plastic. Introduction of corrosion table, Use of corrosion table to select piping materials based on corrosion resistance and economy. Piping materials modification for economy – Callading of pipes, Pipelines- Glass lining.	4	6
4. PIPING COMPONENTS Requirement of piping components, different piping components like Elbow, Tee, Flanges, Reducers, Couplings, Nipples, Blinds, Special fittings, Gaskets.	2	4
5. PIPING DESIGN Data required for Piping Design, Effect of velocity of flow with change in size of pipe, Relaxation of Pressure drop of fluid conducted in relation to the size of pipe & velocity of flow. Design Procudure – selection of pipe size by flow rate w.r.t. practical requirements, determining the thickness of	6	10

pipe.

6. SPECIAL DESIGN CONSIDERATION Steam piping - Insulation , Steam traps, Application and Methods of installation, Water piping - Venting Compressed air piping Gas piping -Toxic, Flammable	3	6
7. PIPING DRAWING Types of Piping Drawings - Single line & Double line , Symbols of Piping Fitting w.r.t. type of joints, Isometric & Orthographic Piping drawing, Drawing Piping Isometric from Piping Plan with Elevation levels known, Developed view, Bill of Materials.	8	10
8. PIPING FABRICATION Activities in Fabrication of Pipelines, Welding of Pipe joints, Welder Qualification, Importance of GTAW process for root run for high quality piping, Stove pipe Technique for cross country pipelines, Piping edge preparation. Bending of Pipes: Cold bending - Draw pipe bends. Compression pipe bends, 3 point bend & Roll bend. Hot bending- Bending of pipe on a steel plate bed, Fabrication of pipe bend by cutting & Welding – 2 pieces, 3 pieces, 4-pieces. Min tenth of pipe required. Numerical examples. End profile of pipe piece. Hole and End profile for Tee and Y branching.	12	16
9. PIPING INSULATION & PIPING FLEXIBILITY Insulations: Hot & Cold, Different types of hot & cold Insulation, Temperature range of use., Forms of insulation, Process of applying Insulation. Flexibility: Need of piping, Fitting used to induce flexibility, Loops, Types of pipe supports, Cold springing, Expansion joints, Bellows.	3	6
10. PIPING INSPECTION AND TESTING In process inspection, Hydro testing.	3	5
Total	48	75

TERM WORK

1. Drafting of P&ID's symbols
2. Drafting Piping components
3. Drawing of Equipment Nozzle Schedule
4. Drawing of Piping Plot Plan
5. Drawing of Piping Isometric drawing
6. Preparation of Materials Take Off (BOM)
7. Hole profile of Header pipe & End profile of Branch pipe for various branches like Tee, Y etc

ORAL EXAMINATION

The oral Examination shall be conducted based on the contents mentioned in the term work.

REFERENCE BOOKS

1. Piping handbook by Nayyar, Mac GRawhill.
2. Process piping Designs Vol-I &Vol-II, by Weaver.
3. Process piping drafting by Weaver.
4. Piping guide by Sherwood.
5. Pipefitters Handbook by Lindsey.
6. Pipe welding procedures by Rampaul.

(FE613) SURFACE TREATMENT & CORROSION PREVENTION

1. RATIONALE: The study of Fabrication Engineering will not be complete unless the cause of corrosion and surface treatment is studied. As corrosion is a natural phenomenon, it causes huge loss of property. Therefore, this course is introduced which comprises the study of theory of corrosion, surface preparation and treatment and corrosion prevention methods.

2. **TEACHING AND EXAMINATION SCHEME**

Course Code & Course Title	Periods/ weeks in Hours			Total Credits	Examination Scheme				
					Theory marks		Practical marks		Total marks
	L	T	P	C	TH	TM	PR/OR	TW	
FE613 Surface Treatment & Corrosion Prevention	3	-	2	5	75	25	25	25	150

3. COURSE CONTENT:	**Hrs.**	**Mks.**
1.INTRODUCTION TO CORROSION	3	4.5

Definition of corrosion, environments, corrosion damage, materials and other properties, classification of corrosion.Corrosion Engineering.Implication of corrosion.

2. THEROY OF CORROSION	6	9

Corrosion rate expressions, electro-chemical aspects, electro-chemical reactions, polarisation, passivity, measuring corrosion as it happens, corrosion at elevated temperature.Environmental effects-effects of oxygen and oxidizers, effects of velocity and temperature.Effects of concentration of corrosive solutions, effects of galvanic coupling. Metallurgical aspects: metallic, ringworm corrosion.

3. CORROSION AND ITS CLASSIFICATIONS.	12	16.5

Uniform corrosion.

Localised corrosion: Macroscopic corrosion:- Galvanic or Two –Metal corrosion - EMF and Galvanic series, environmental effects, distance effect, area effect.

Crevice corrosion:- Environmental factors, mechanism, Filiform corrosion.

Pitting:- Pit shape and growth, autocatalytic nature of Pitting, solution composition, velocity, metallurgical variables, evaluation of pitting damage.

Selective leaching:- Dezincification- Characteristics, mechanism, prevention.

Graphitization, other alloys systems, effect of high temperatures.

Erosion Corrosion:- Surface films, velocity, turbulence, impingement, galvanic effect, nature of metal or alloy, combating erosion corrosion, cavitations damage, fretting corrosion. Exfoliation.

Microscopic corrosion:- Intergranular corrosion:- Austenitic stainless steels, weld decay, control for Austentic stainless steels, knife-line attack, intergranular corrosion of other alloys.

Stress corrosion:- Crack morphology, stress effects, time of cracking, environmental factors, metallurgical factors, mechanism, methods of prevention, corrosion fatigue.

Hydrogen damage:- Characteristics, environmental factors, hydrogen blistering, hydrogen embrittlement and prevention.

4. SURFACE PREPARATION 10 18

Introduction. Mechanical: Cleaning of steel by blasting, Blasting methods:- sand blasting, quartz blasting, shot blasting, copper slag blasting, shot peening, hydroblasting and blasting plant. Tumbling and cleaning:- Barrel tumbling, rotary blat tumbling.

Surface treatment by Barreling:- Burnishing , barreling.

Chemical: Cleaning of steel by solution and vapours:- degreasing, cold solvent washing, acid cleaning, soaking, spraying cleaning, barrel cleaning, cleaning by steam gun, rotary spray washers, rotary spray brush cleaning. Cleaning of steel by acid:- descaling, pickling, acid pickling. Cleaning of steel by salt bath:- salt bath descaling, sodium hydride process, caustic soda baths, nitrate baths, sodium hydroxide baths - Kolene process.

Electrolytic:- Electrolytic degreasing, Electrolytic cleaning and Electrolytic pickling.

5. CORROSION PREVENTION (brief) 17 27

Cathodic and Anodic protection - Basic theory, cathodic protection, sacrificial anode method, practical applications, Impressed Current Cathode Protection (ICCP) - Its applications, anodic protection, impending ion reaction.

Corrosion control by Barrier coating.Requirement of coatings. Corrosion control by painting:- Composition and characteristics of paints, types of paints - water-based paints , oil-based paints, oleo resinous paints (varnishes). Primers - prefabrication, pre-treatment. Resin - alkyds, epoxide resins, coal tar epoxides ,polyeuethanes, vinyls, chlorinated rubbers. Paint failure. Plastic coatings or Powder coatings:- Properties, methods - dipping, spraying , rolling, trowelling and brushing. Coating materials - Nylon, Polyethylene (polythene), PVC, PTFE, Polyeurethane. Metallic coatings:- Properties, Behaviour, Methods – electroplating, hot dipping, spray coats, clad coatings, diffusion coatings. Coatings of zinc, cadmium, aluminium, nickel, chromium and tin.

Control by environmental change:- soil as an environment, atmospheric corrosion, modification of electrolyte-anode reaction, cathode reaction and ionic conduction through electrolyte, electron conduction through metal. Use of anodic inhibitors, cathodic inhibitors and absorbtion inhibitors.Control of aqueous environment in steam generators and cooling systems.

Control by design:- avoiding bimetallic corrosion cells, avoiding differential aeration cells such as crevices, debris traps, inadequate drainage and ventilation , water absorbent, sound proofing insulation, tanks & pipe systems, stray current corrosion.

Total 48 75

TERM WORK

1. Demonstration to measure corrosion rate on M.S. samples in sea water by weight loss/ gain method.
2. Demonstration of surface preparation & treatment on metals .
3. Demonstration on corrosion prevention methods like – Paint coating, Electroplating (Nickel plating, Zinc plating), Anodising, Phosphating, Tinning, Galvanizing.
4. Three industrial visits to study the causes, effects of corrosion and its prevention methods.
5. Study of corrosion rate by accelerated methods (Potentiostatic)

PRATICAL/ ORAL EXAMINATION

The practical / oral examination will be based on the report written by the students on the industrial visits, experiments and case studies.

TEXTBOOKS

1. Corrosion Engineering by Fontana and Greece
2. Corrosion Prevention Practice by G.A. Balalaev
3. The Surface Treatment of Steel by Eric M Simons
4. Corrosion for students of Science and Engineering by K.R. Trethoway and Jchamberlain

REFERENCE BOOKS

1. Handbook of Corrosion Data by Bruce D. Graig.
2. Elementary Aspects of Corrosion by Dr. P. Neufeld.
3. The Chemical Engg Guide to Corrosion Control in the Process, Industries Edited by Richard W. Greene and the staff of Chemical Engineering by McGraw Hill Publication Co. New York.
4. Corrosion Control by Samuel A. Bradford
5. Controlling Corrosion in Process Equipment Edited by Staff of Chemical Engg. McGraw Hill Pub. Co. New York
6. Corrosion Testing for Metal Finishing Editor V. E. Carter published Butterworth Scientifica London.

(FE614) OFF-SHORE STRUCTURES

1. RATIONALE: New commercial sources of energy and minerals critical to human existence are being sought from the oceans due to the depletion of conventional land-based resources. Through this course students will learn the various aspects of ocean environment, type of offshore structures, materials and equipments used for construction. The installation of submarine pipeline used for transfer of oil & gas will be studied along with the repair works.

2. TEACHING AND EXAMINATION SCHEME

Course Code & Course Title	Periods/ weeks in Hours			Total Credits	Examination Scheme				
					Theory marks		Practical marks		Total marks
FE614 Off shore structure	L	T	P	C	TH	TM	PR/OR	TW	
	3	-	2	5	75	25	25	25	150

3.COURSE CONTENTS

	Hrs.	Mks.
1. OCEAN RESOURCES Minerals- poly7metalic nodules, placer deposits, oil and gas, gas hydrates	2	4
2. OCEAN ENVIRONMENT Waves - wave height, wave period, wave direction, design wave height. Tides-different tide levels. Currents- Variation of currents with depth. Wind-Variation of Wind speed and direction, wind speed during cyclones. Seabed characteristics- brief note on marine geotechnical investigations, geophysical survey, drilling and sampling procedures, in situ testing techniques. Temperature and salinity variations with dept.	5	08
3. TYPES OF OFFSHORE STRUCTURES INCLUDING BASIC DESIGN CRITERIA Exploratory drilling structures- Jack-up-rigs, semi-submersibles, drill ships, Productions platforms- fixed structures (gravity and piled) – compliant structures (TLP and articulated tower) Single point mooring system; Mention of forces acting on the structures.	12	16
4. SUBMARINE PIPELINES Installation methods- Lay barge method, reel barge method, tow method, pipeline trenching methods- Jetting method, mechanical cutting, fluidization method, plowing method.	5	08
5. EQUILIBRIUM OF FLOATING BODIES Archimedes Principle; Buoyancy centre of Buoyancy- Metacentre – Type of equilibrium of floating body- maximum length of body floating in water; Numerical problems.	8	12
6. MATERIALS AND FABRICATION IN MARINE ENVIRONMENT Steel structures for offshore environment- types of steel and its strength requirements, fabrication and welding details - erection of structural steel- coatings and corrosion protection – Non-destructive testing of weld, concrete mixes and their proportion concept of pre- stressed concrete – placing of concrete – curing. Causes failure and of structures.	8	12
7. CONSTRUCTION TECHNOLOGY	8	15

Marine operations – cranes – barges – derrick barges – jack-up barges, launch barges: Installation of offshore structure – steel jackets – removal of jacket from barge lifting and launching – installation on the sea floor; Diving and underwater works: underwater concreting and grouting: Repair and maintenance of offshore structures, Repair methods – surface welding, hyper – baric welding, mechanical connectors, full encirclement sieves, flexible pipe repair.		
Total	48	75

3. Term Work Assignments:

1. Rotary drilling rig and its components

Power system -Hoisting system -Rotating system –Circulating system -Well-controlled equipment, Auxiliaries

2. Preparing the layout drawings of different offshore platforms.

4. References books:

1. Ben. C. Gerwick Jr. Construction of marine and offshore structures, A Wiley Interscience publications , John Wiley & Sons, New York Chichester Brishare, Toronto, Singapore.
2. F.L.L. B Carneiro, Offshore Structures Engg-I, Gulf Publishing Co. Book Division, Houston, London, Paris, Tokyo.
3. F.L.L. B Carneiro, Offshore Structures Engg-II, Gulf Publishing Co. Book Division, Houston, London, Paris, Tokyo.
4. Charkrabarti, S. K. 1987, Hydrodynamics of offshore structures, Coputational Mechanics Publications, Southampton, Boston, 440p
5. Dawson, T.H, 1983, Offshore structural engineering, Prentice Hall Inc., Englewood Cliffs, new Jersey, 346p
6. DNV, 1977, Rules for the design construction and inspection of offshore structures, Det Norske Ventas, Norway, 67p
7. Graff, W. J., 1981, Introduction to offshore structures: Design, fabrication, Installation., Gulf Publishing Company, Honston, USA, 345 p
8. Khurmi, R.S 1983, A textbook of Applied Mechanics, S.Chand& Company, New Delhi, 699p
9. Mousselli, A.h, 1981 Offshore pipeline design, analysis and methods, Penn well Books, Pennwell publishing Company, Oklahoma, 193 p.
10. Poulos, H.G., 1988, Marine Geotechnics, Unwin Hyman, London, UK, 473p

(FE616) REPAIR AND MAINTENANCE WELDING

1. **RATIONALE**: This course aims to equip the Fabrication Technician to use the wide knowledge he possess of welding process, in repair and maintenance. In this important area, parts which are put out of service, are reclaimed and made fit for reuse economically, thus saving the cost considerable. To achieve this goal, the topic on repair and maintenance welding is dealt with extensively. Also since hard facing is a major maintenance welding process, it is dealt with a large extent. The use of plastic components are increasing day- by –day, largely replacing the metallic components because of various advantages like low weight low cost etc. Therefore repair of plastics by welding is also included.

2. TEACHING AND EXAMINATION SCHEME

Course Code & Course Title	Periods/ weeks in Hours			Total Credits	Examination Scheme				
					Theory marks		Practical marks		Total marks
	L	T	P	C	TH	TM	PR/OR	TW	
FE616 Repair and Maintenance Welding	**3**	**-**	**2**	**5**	**75**	**25**	**25**	**25**	**150**

3. COURSE CONTENT: **Hrs.** **Mks.**

1.INTRODUCTION TO REPAIR AND MAINTENNACE WELDING **2** **6**

Maintenance and repair situations, maintenance and repair welding, Economics of repair.

2. **A SYSTEMANTIC APPROACH TO MAINTENANCE AND REPOAIR WELDING** 10 20

Planning, Planning checklist. A Welding repair Decision Model: Identify welding repair need, determine the nature of the defect, non-destructive examination, destructive examination, determination of root cause of failure, making the welding repair decisions, determine of base-metal weldability, determining the welding process, determining matching filler metal, shrinkage and distortion, determine welding standards, establishing the repair procedure, fit up requirements, thermal requirements, welder qualifications and preparation, preparations of the defect area, welding repair performance, inspection and testing, welding repair success or corrosion, part protection and return to service.

3.APPLICATIONS OF REPAIR WELDING 10 20

Introduction .

Case studies: Repairing cold storage tank leaks, repair welding of a pressure vessel, repair of fertilizer processing equipment, repair of casting and forging, repair of an engine crankshaft, repair welding of fabricated structures.

4. INTRODUCTION TO HARDFACING 3 6

Introduction . Metallurgy of hard facing deposits, types of wear importance of buffer layers - compatibility and dilution, deposit hardness variables and control , control distortion, preheating, placement of weld deposit, cost of hard facing, initial cost, labour cost, scrap losses thickness of deposit, methods of welding service life.

5. HARD FACING 8 12

Introduction . Hard facing alloys forms, alloy selection, classification of hard facing materials by alloy group, selection for specific application, factors influencing selection, base metal and its preparation for hard facing.

Inspection and Testing.

6. WELDING PROCESS USED FOR HARD FACING 6 12

Selection of Welding process. workpiece factors, properties of base metal, forms and composition of hard facing alloy, properties and quality requirement of the deposits, welder skill cost relating selection factors.

Facing Process. Hard facing b shielded metal-arc welding, hard facing by submerged arc welding, hard facing by open-arc welding ,hard facing by gas metal arc welding , hard facing by gas tungsten – arc welding, hard facing by plasma-arc welding, hard facing by oxy-acetylene welding, comparison of welding process.

7. APPLICATIONS OF HARD FACING 6 12

Oil well drilling tools, earth moving and agricultural applications, mining and quarrying and materials handling tools and mills equipment hand facing and weld repair of metal working tools.

8. REPAIR WELDING OF PLASTICS 3 8

Principle of Welding plastics, commonly welded plastics, surface preparation, plastic welding process: heated tool welding, hot gas welding, high frequency welding, ultrasonic welding, friction welding.

Inspection and Testing.

Total 48 100

TERM WORK

The term work shall consist of the following jobs/ experiments:

1. Prepare and test the hardness of the hard facing deposit layerwise(3 layers) , to illustrate the effect of dilution.
2. Prepare sample of hard facing manganese steel and illustrate work hardening.
3. Hard facing of shovel teeth, with buffer layer of low hydrogen electrodes followed by chrome-carbide hard faced layer(3 Nos.)
4. Three field visit to a mining repair workshop/ Engg. Workshop.
5. Repair of cast iron block.

The student should maintain a neatly written journal for the above done jobs and field visits.

ORAL EXAM

An oral examination shall be conducted by the examiners, based on the topics detailed in the syllabus and term work journal maintained by the student.

REFERENCE BOOKS.

1. Metals hand book –ASM, volume 6-Welding and Brazing
2. Metals hand book-ASM, Volume 1-Properties an selection of metals.
3. Welding hand book-AWS. Eighth edition, Volume 3- Materials and applications.-Part I
4. Modern Arc. Welding Technology, by S.V. Nadkarni, Advani-oerlikon Ltd.
5. A text book on Welding Technology, by Dr. O.P. Khanna, DhanpatRai& Sons Publications,.

(ME615) RENEWABLE ENERGY SOURCES

1. **RATIONALE**: The power demand in the country is increasing at a very fast rate & power production is not able to keep pace with the power demand. The resources required for the generation of power are gradually getting exhausted. Therefore it becomes necessary to investigate the possibility of producing energy from non – conventional sources. Researches and efforts are being made to utilize the non conventional energy for power generation which in turn can meet the power demand. It is also necessary to know the basics of energy conservation. Looking into this need, this course has been introduced at the final year level as an optional course.

2. **TEACHING AND EXAMINATION SCHEME**

Course Code & Course Title	Periods/ Week (In Hours)			Total Credits	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
ME 615 RENEWABLE ENERGY SOURCES	**L**	**T**	**P**	**C**	**TH**	**TM**	**PR/ OR**	**TW**	150
	3	-	2	5	75	25	25	25	

Minimum passing % : Theory 40% and Practical 40% *Duration of Theory Paper: 3 Hrs.*

3. **COMPETENCY TO BE DEVELOPED THROUGH THIS COURSE**

The student should be able to develop awareness for effective utilization of renewable energy sources, identify different components of solar energy devices, wind energy devices and biomass plant and apply principles of energy conservation and energy audit.

4. **DETAILED COURSE CONTENT**

Unit 1 Introductionto Energy Sources Introduction. Major sources of energy: Renewable and Non–renewable. Primary and secondary energy sources. Energy scenario in India . Prospects of renewable energy sources. Need of renewable energy sources.
Unit 2 Solar Energy Solar Radiation: Solar Radiations at earth's surface. Flat plate Collectors: Construction and working of typical liquid collector and typical air collector. Concentrating collectors: Construction and working of parabolic trough

reflector, mirror strip reflector, Fresnel lens collector.

Solar energy storage systems: Need for energy storage. Thermal storage:- packed bed storage type, Electrical Storage: - battery storage type, Mechanical storage:- pumped hydroelectric storage, compressed air storage, flywheel storage. Solar pond:- principle of operation, description of non-convective solar pond, applications.

Applications of Solar energy:- Space heating-passive and active heating systems. Solar photovoltaic's- principle, basic photovoltaic system for power generation, applications. Solar water heater, solar distillation, solar cooker (box type), solar furnace, solar pumping, solar drier. Agriculture and Industrial process heat. (No derivations and numericals)

Unit 3 Wind Energy

Basic principle of wind energy conversion. Power in wind, Available wind power formulation, Power coefficient, Maximum power. Main considerations in selecting a site for wind mills. Advantages and limitations of wind energy conversion. Classification of wind mills. Basic components of a wind energy conversion system. Construction and working of horizontal axis wind mill. Applications of wind energy:-Basic wind energy conversion system with energy storage; wind assisted gas turbine generating unit; wind energy system with battery storage. Environmental aspects of wind energy system.

Unit 4 Energy from Biomass

Introduction. Biomass resources. Biomass conversion technologies:-direct combustion, thermo-chemical conversion, bio-chemical conversion. Biogas generation. Types of biogas plants:- floating drum type and fixed dome type,their construction and working. Factors affecting biogas generation. Thermal gasification of biomass. Gasifiers: - a) fixed bed gasifier -updraught,downdraught and cross draught b)fluidized bed gasifier. Applications of gasifier.

Unit 5 Energy Conservation

Global and Indian energy market. Need and importance of energy conservation. Principles of energy conservation. Energy audit. Types of Energy Audit. Concept of Green Building, Carbon footprints, Star Rating of Appliances.

5. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)

Unit No.	Topic	Teaching Hours/ Semester	Total Marks
1.	Introduction to Energy Sources	04	6
1.	Solar Energy	19	32
2.	Wind Energy	11	15
3.	Energy from Biomass	08	12
4.	Energy Conservation	06	10
	Total	**48**	**75**

6. SUGGESTED LIST OF ASSIGNMENTS

Term work shall consist of the record of the following assignments:

S. No.	Unit No.	Assignments
1	**1, 5**	To collect information about global and Indian energy market.
2	**2**	To perform an experiment on solar flat plate collector used for water heating.
3	**2**	Setting up a photovoltaic cell for lighting with focus on orientation of panels and measuring output in terms of voltage & current.
4	**2**	Perform an experiment using a solar cooker.
5	**2**	Visit to plant of solar heating system for hotel/hostel/railway stations etc and write a brief report on the visit.
6	**3**	To study construction and working of horizontal axis wind mill or to visit nearest wind farm.
7	**4**	To visit biomass / biogas plant of Municipal waste or elsewhere and write a brief report on the visit.
8	**5**	Perform energy audit for workshop / Office / SSI unit.

7. SUGGESTED LEARNING RESOURCES

S. No.	Name of Author	Title of the Books	Name of the Publisher
1	Dr. B. H. Khan	Non Conventional Energy Resources	Tata McGraw Hill
2	G. D. Rai	Non conventional energy sources	Khanna Publishers
3	S. P. Sukhatme	Solar energy Principles	Tata McGraw Hill
4	P. H. Henderson	India – The Energy Sector	University Press
5	D. A. Ray	Industrial Energy conservation	Pergaman Press
6	W. C. Turner	Energy Management handbook	Wiley Press
7	S,Rao,B. Parulekar	Energy Technology	Khanna Publishers

(ME617) MODERN MARKETING MANAGEMENT

1. RATIONALE

In this day of competitive business, a course in marketing management is of great importance to the entrepreneur, industrialists, and person working in marketing related department. It is said that producing itself is not difficult, but to make people buy the produce is. Marketing begins before the product exists and continues long after the product is sold. The student will be able to understand the nature and scope of marketing management.

2. TEACHING AND EXAMINATION SCHEME

Course Code & Course Title	Periods/ Week (In Hours)			Total Credits	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
ME617 Modern Marketing Management	L	T	P	C	TH	TM	PR/ OR	TW	150
	3	-	2	5	75	25	25	25	

Minimum passing % : Theory 40% and Practical 40% *Duration of Theory Paper: 3 Hrs.*

3. COMPETENCY TO BE DEVELOPED THROUGH THIS COURSE

The course content should be taught and implemented with the aim to develop different types of skills leading to the achievement of the competency – ***Apply the principles of marketing management to enhance the market and sale of the product.***

4. DETAILED COURSE CONTENT

Unit 1 Fundamentals of Marketing Management

- Define: marketing, market and marketing management

- Explain simple model of marketing process

- Understand various stakeholders of business: customers, employees, shareholders, society, government, suppliers, distributors , etc

- Marketing Management orientations:- Discuss :(a) production concept (b) the product concept (c) the selling concept (d) the marketing concept (e) the societal marketing concept

- Building customer relationships: Definition of Customer relationship management (CRM), importance of CRM, customer value and customer satisfaction

- Discuss about Customer loyalty programs and customer retention programes with few examples

- Importance of retaining existing customer v/s acquiring new customer

- Changing nature of customer relationship in modern times: discuss with examples (a)selective relationship management (b) long term relationships (c)relating directly

-Importance of ethics and social responsibility while marketing

- discuss the growth of not-for-profit marketing with examples

Unit 2 Marketing segmentation, Targeting, Positioning and Marketing Mix

- Discussion on segmentation based on (a)geographic factors (b) demographic factors (c) psychographic factors (d) behavioral factors. Explain with real world examples.

- Definition of target marketing. Brief discussion on target marketing with examples.

- Understand the concept of Market Positioning with examples from corporate world

- Marketing Mix: discuss in detail, with examples, the four P's of marketing.

- Marketing Environment: discuss in detail, with examples, (a)Political environment, (b)economic environment, (c) social environment, (d) technological environment and (e) natural environment

Unit 3Marketing research

-Definition and scope of Marketing research

- discuss various steps involved in marketing research

(a) defining the problems and research objectives

(b) developing the research plan

(c) gathering and analyzing the data

(d) interpreting and reporting the findings

- Brief discussion on gathering of secondary data and primary data

- Research approaches for gathering primary data, which shall include: observational research, survey research, marketing research and online marketing research.

Unit 4 Consumer Behavior

- Discuss, with examples or case studies, various factors influencing consumer behavior: Cultural factors, social factors, personal factors, psychological factors.

- Discuss in detail ,with examples, following types of buying decision behavior:

(a) Complex buying behavior

(b) Dissonance –reducing buying behavior

(c) Habitual Buying behavior

(d) Variety seeking buying behavior

-Brief discussion on stages in buyer decision process: recognition of need, information search, evaluation of alternatives, purchase decision, post purchase behavior.

Unit 5 Business to Business Marketing (Industrial Marketing)

- Define business markets and explain how business markets differ from consumer markets.

- Discuss buying situations in industry- straight rebuy, new task, modified rebuy.

-Discuss in detail "buying centers"

-Major influences on Business buyers

Unit 6 Product , Services and Branding

- Difference between product and services

- Classification of products: consumer products and industrial products

- Product life cycle and various stages involved in it

- Discuss in brief product and service decisions: product attributes, branding, packaging, and labeling and product support services.

- Branding Strategy: Brief introduction to brand positioning, brand name selection, brand sponsorship and brand development.

Unit 7 Marketing Channels (Distribution Channels)

-The nature and importance of Marketing Channels
-Number of Channel Levels: Understand levels in Direct Marketing Channels and Indirect marketing Channels
-Understand Consumer marketing channels and Business marketing channels
-Nature and importance of Marketing Logistics
-Goals of Logistics system
-Major Logistics Function: Warehousing, Inventory Management, Transportation, Logistics Information Management
-Discuss the concept of Third Party Logistics (3PL) with the help of examples.

Unit 8 Sales Management

-Discuss functions of salespeople: Prospecting, targeting, communicating, selling, servicing, information gathering, allocating
- What makes a good sales representative
- Understand in detail various steps in selling process: Prospecting and qualifying, pre approach, approach, presentation and demonstration, handling objections, closing, follow-up
-Direct Marketing:

- Definition and concept of direct marketing
- Benefits and growth of direct marketing
- Use of customer database in direct marketing
- Forms of direct marketing: telephone marketing, direct mail marketing, catalog

marketing, direct response television marketing, kiosk marketing

- Ethical issues in direct marketing: (a) Irritation, unfairness, deception and fraud (b) Invasion of privacy, etc.

Unit 9 Marketing in the digital age

-Brief discussion on major force shaping the digital age: digitalization and connectivity, the explosion of the internet, new types of intermediaries, customization, etc.

-Definition of E-business, E-commerce and E-marketing

-Understand benefits of E-commerce to the buyers

- Understand benefits of E-commerce to the sellers

-E-marketing domains (discuss each domain with examples)

- Business- to- Consumer (B2C)
- Business-to- Business (B2B)
- Consumer –to- Consumer (C2C)
- Consumer –to – business (C2B)

-Sources of E-commerce revenue: Income from sale of product and services, advertising income, sponsorship income, alliance income, membership and subscription income, transaction commissions and fees, market research and information fees, referral income, etc.

-Discuss about Setting up an E-marketing presence: creating a website,online advertising, creating or participating in web communities, using email

-Discuss the promise, challenges and issues in E-commerce

-Mobile Commerce (M-Commerce): Concept of M-Commerce, Market size of M-commerce, Examples of successful M commerce businesses,

-Latest trends in digital marketing

5. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)

Unit No.	Topic	Teaching Hours/ Semester	Total Marks
1	Fundamentals of marketing management	5	9
2.	Marketing segmentation, targeting , positioning and marketing mix	9	12
3.	Marketing research	5	6
4.	Consumer behavior	5	6
5.	Business to business marketing (Industrial Marketing)	3	6
6.	Product, services and branding	4	6

Unit No.	Topic	Teaching Hours/ Semester	Total Marks
7.	Marketing Channels	3	6
8.	Sales Management	8	12
9.	Marketing in the digital age	6	12
	Total	**48**	**75**

6. SUGGESTED LIST OF EXPERIMENT

Sr no	Unit no	assignments
1.	1	Visit a Marketing department of a business firm.
2.	3	Prepare a report on resources available at the above firm.
3.	4	List out the roles of various staff from the firm.
4.	6	What products are they marketing?
5.	7	Give your detailed list of success of the products.

Reference books: -

Sr no	Name of author	Title of books	Name of publisher
1.	Philip Kotler.	Principles of marketing	prentice Hill (I) Ltd
2	J. C. Gandhi,	Marketing a managerial introduction	Tata McGraw Hil
3	R. S.Davar	Modern Marketing Management .	progressive corporation pvt. Ltd
4	Philip-Kotler-	Marketing Management –.	prentice (I) Ltd
5	Alexander	Industrial Marketing	cross& still-d. B. TaraporewalaPvt. Ltd
6	Charles Kirkpatrick	Salesmanship	
7.	R. S. Davar	Salesmanship and publicity	Progressive Corporation Pvt. Ltd
8	Boyd, Westfall and Stasch	Marketing Research	all India Traveller Book Seller, Delhi

(ME618) SAFETY ENGINEERING

1. RATIONALE

With rapid advances in industrial processes, new types of danger to life and health are being increasingly introduced.Safety of life and assets has always been at a top precedence in oil and gas industry. Keeping in mind this course is designed in such a way that aspirants, who wish to get into designing, may get a broad overview of safety norms and related engineering practices**.** Therefore an attempt has been made in this subject to highlight the different safety aspects, laws and rules to combat the cause of accidents.

2. TEACHING AND EXAMINATION SCHEME

Course Code & Course Title	Periods/ Week (In Hours)			Total Credits	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
ME618 SAFETY ENGINNERING	**L**	**T**	**P**	**C**	**TH**	**TM**	**PR /OR**	**TW**	150
	3	-	2	5	75	25	25	25	

Minimum passing %: Theory 40% and Practical 40% *Duration of Theory Paper: 3 Hrs.*

3. COMPETENCY TO BE DEVELOPED THROUGH THIS COURSE

The course content should be taught and implemented with the aim to develop different types of skills leading to the achievement of the competency.

4. DETAILED COURSE CONTENT

Unit 1 INTRODUCTION TO INDUSTRIAL SAFETY

Introduction-Safety -Goals of safety engineering. Need for safety. Safety and productivity.

Safety organization- objectives, types, functions, Role of management, supervisors, workmen, unions, government and voluntary agencies in safety, Safety policy,Safety Officer-responsibilities& authority. Safety committee-need, types& advantages.

Unit 2 ACCIDENT CAUSES AND COSTS

Definition of accidents,Injury, Unsafe act, Unsafe Condition, Dangerous Occurrence, Reportable accidents.

Classification of accidents, Causes of accidents and factors affecting it, Cost of accident to the

management, Accident prevention method-Engineering, Education and Enforcement.

Unit 3 SAFETY EDUCATION , TRAINING & HOUSING KEEPING

Safety Education & Training -Importance, Various training methods, Effectiveness of training, Behaviour oriented training. Communication- purpose, barrier to communication. Role of government agencies and private consulting agencies in safety training – creating awareness, awards, celebrations, safety posters, safety displays, safety pledge, safety incentive scheme, safety campaign – Domestic Safety and Training.

Housekeeping: Responsibility of management and employees,Advantages of good housekeeping, 5 s of housekeeping.

Work permit system- objectives, hot work and cold work permits. Typical industrial models and methodology. Entry into confined spaces.

Unit 4 SAFETY IN MATERIAL HANDLING

Classification of safety in Material Handling; Manual Handling; Effective methods of lifting ; Fall- Definitions; Causes of common fall – preventive measures; Types of falls and safety regarding falls.

Inbuilt safety in cranes,hoist& lift, chain pulley blocks, mixers, conveyors etc.

Unit 5 HAZARD IN INDUSTRY & THEIR PREVENTION

Fire hazards and prevention: Fire detection and control; Common safeguarding methods and devices; pressure vessel hazards; causes of pressure vessel accidents; controlling fire in pressure vessel; common explosions, need for a safety valve and introduction to boiler acts.

Hazards in chemical industry: classification of hazardous chemicals; properties of flammable chemicals; safety in storage and transportation of flammable liquids; types of chemical emergencies and their prevention.

Noise: Introduction to noise; Effect of noise; Remedial measures to combat noise.

Unit 6 ACCIDENT REPORT & INSURANCE COVERAGE

Benefits of accident report; Accident report forms; Cost of accidents-Computation of Costs-Utility of Cost data.

Accident investigation –Why? When? Where? Who? & How?

.Process of Investigation –Tools-Data Collection-Handling witnesses- Case study.

Accident analysis –Analytical Techniques like change ,barrier and tree analysis

Plant safety inspection, types, inspection procedure, Safety sampling techniques, Job safety analysis (JSA), Safety surveys and Safety audits.

Definition of insurance; Types of insurance; Advantages of insurance; Life insurance;

Advantages of life insurance; kinds of life insurance policies; procedure of making LIC; settlement of life insurance claims
Unit 7 PERSONAL SAFETY Personal protection in the work environment, Types of PPEs, Personal protective equipment-respiratory and non-respiratory equipment. Standards related to PPEs. Monitoring Safety Performance: Frequency rate, severity rate, incidence rate, activity rate.
Unit 8 WELFARE PROVISIONS &ROLE OF FACTORY INSPECTOR Labour welfare provisions; Working Hours; Definition of inspection; objectives of factory inspector; powers of inspectors; penalties etc

5. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)

Unit No.	Topic	Teaching Hours	Total Marks
1.	Introduction to industrial safety	04	05
2.	Accidents- causes and costs	03	05
3.	Safety Education ,Training & Housekeeping	08	12
4.	Safety in Material Handling	06	12
5.	Hazards in Industry and their prevention	07	12
6.	Accident Report & Insurance Coverage	10	15
7.	Personnel Safety	06	08
8.	Welfare provisions and Role of Factory Inspector	04	06
		48	**75**

6. SUGGESTED LIST OF EXPERIMENTS

The experiments should be properly designed and implemented with an attempt to develop different types of skills leading to the achievement of the competency.

S. No.	Experiment
1.	Write report on all the personnel safety and machine safety students are observing while working in mechanical workshop.
2.	Visit the industry and Prepare the Detail report on safety measures observed in industry.
3.	Prepare the Escape Route Layout of your school Building or House.
4.	Survey a nearby market and prepare a report on safety equipment and their specification available in market.
5.	To prepare at least one safety poster or safety Display that can be used in surrounding area.
6.	Show the video containing fire accidents in various situations and an exercise to select the fire extinguisher to prevent the accident.
7.	Compile information from internet regarding accidents occurred in industries due to lack of safety measures.
8.	Collect information and prepare a report about the different types of insurance companies and policies available in Goa.

7. SUGGESTED LEARNING RESOURCES

Sr.no.	Author	Title of Books	Publication & Year
1		Relevant India Acts and Rules	Government of India.
2	Ronald P. Blake	Industrial Safety	Prentice Hall, New Delhi, 1973
3	Ted S. Ferry	Modern Accident Investigation and Analysis	John Wiley & Sons
4	NaseerElahi	Industrial Safety Management	Kalpaz Publication 2006
5	H.l. kalia	Industrial Safety And Human Behaviour	Aitbs Publishers, India 2011
6	A. N. Saxena	Industrial Safety	National Productivity Council, 1978

(IE6**) INSTIUTIONAL ELECTIVE

1. RATIONALE :

It has been observed that the curriculum prescribed, is many times out of context of Industry, on account of the pace with which technology development is taking place at Industry end. Due to this, gap exists between the Industry requirement of manpower and manpower produced by the Polytechnics. Board takes some time to incorporate the development of technology in the curriculum and many a times technology becomes outdated when it is incorporated in the curriculum. Further the expertise to train students as per Industry current requirement is available at the institute, but the same cannot be taught to students, as it is not a part of curriculum.

To address this situation, Board has decided to permit Institutions affiliated to Board, to identify such technologies or other aspects and teach the same to the students as an elective subject called "Institutional Elective". Through this Institutional Elective subject, Institutions will be able to cater to the requirements of Industry by identifying their immediate requirement and prepare the students for the requirement by developing the curriculum in consultation with the Industry.

As many a time's same subject may not be offered more than one or two years, a non conventional way of teaching – learning may be required to be adopted. Participation of Industry experts, guest lecturers, visit to Industry, exploring the knowledge available on net, etc may be essential to achieve the objectives.

2. TEACHING AND EXAMINATION SCHEME :

Course code & course title	Periods/Week (in hours)			Total Credits	Examination Scheme				
					Theory		Practical		Total Marks
IE6** INSTIUTIONAL ELECTIVE	L	T	P	C	TH	TM	PR/OR	TW	
	3	-	2	5	75	25	25	25	150

3. DETAILED COURSE CONTENTS :

a) Curriculum shall be drafted by the concerned department by interacting with Industry counterpart in regards to the Newer Technology required to be transferred for purpose of Teaching /Learning process.
b) Department shall work out the modalities of execution of the curriculum at Industry/Institute Level.
c) Curriculum shall be forwarded to Board for approval before its implementation.

SEMESTER VIII

(FE801) FABRICATION INPLANT TRAINING – II

Course code	Name of Course	EXAMINATION SCHEME				Total
		TW		PR/OR		
		Daily Diary	Progressive Assessment	Training Report	Report Assessment & Seminar/Viva	
FE801	Fabrication Inplant Training -II	50	50	50	50	Grade

Rationale:- The diploma programme has been designed as a sandwich programme. The students are required to undergo industrial training for two terms in fifth and eighth terms. The industrial training has been included as a compulsory component of the curriculum in order to cater to the needs of some of the activities, which cannot be taken up in the institution. At the same time, it is expected that the students will develop right attitudes through this process. It is assumed that the employability of the students will increase because of industrial training.

Objectives:- To orient the students with the environment of the industry and make them familiar with the current industrial processes and practices. To study the equipment/ machines processes which cannot be demonstrated in the institution.To provide opportunity to the students to solve the industrial problems.To develop right type of attitudes.To collect information/ data for project work and seminars.

Students are expected to perform the following jobs/ assignments/ activities during the training period.

1. Study of various departments and their functions in the industry.
2. Receipt, Inspection and handling of raw materials.
3. Storage of raw materials.
4. Production planning procedures.
5. Processing and production of the various products in the industry.
6. Study and interpretation of fabrication drawings.
7. Quality Control procedures.
8. Maintenance of Machinery and equipment‘s.
9. Safety measures being followed in the industry.
10. Procurement and marketing procedures.
11. Management aspects of the industry.
12. Scrap disposal procedures being followed in the industry.

G. The Approximate Time allocation :

Orientation in the Institute	1 day
Training in the industry	22 weeks
Report writing and preparation for seminar presentation in the Institute	2 weeks
	Total - 24 Weeks

H. Distribution of Marks:

Daily Dairy	50 Marks
Progressive Assessment	50Marks
Training Report	50Marks
Report Assessment & Seminar/Viva	50 Marks
Total 200 Marks	

I. Daily Diary :

The trainees should maintain a daily diary in the notebook provided by the institution. It should contain a brief account of observations and activities performed everyday by the trainees, to the satisfaction of the supervising authorities in the industry. It should be shown to the supervising authority for counter signature at least once in a week.

J. Assessment:

The assessment of progress should be done approximately once every two months during the training period. This assessment is a multi-step process and is based on the performance & qualification factors suggested below.

K. Seminar:

The Trainee is allowed a minimum, time of 20 minutes to explain and elaborate the work experience gained by him during the training period. A panel of two examiners, (one from the Industry and one from the Institute) shall assess the seminar presentation, for maximum of 50marks .

L. Training Report:

The same panel of examiners shall assess the impact of training on the trainee based on the report presented by him, along with a viva during the seminar presentation and also assess the report. The report should be informative and technical neatly typed on good quality paper with its length approximately 100 pages, preferably with figures, graphs or photographs.

Assessment of Training Report be based on Knowledge, Presentation, Quality of contents and Sketches.

The Numerical Rating

Evaluation Criteria	**Max. Mks.**	**Poor**	**Average**	**Good**	**Excellent**	**Marks Obt.**
Quality of work accomplished	9	0-1	2-4	5-7	8-9	
Quantity of work accomplished	9	0-1	2-4	5-7	8-9	
Job Knowledge	9	0-1	2-4	5-7	8-9	
Dependability	3	0	1	2	3	
Creativity	3	0	1	2	3	
Punctuality/ Attendance	5	0	1-2	3-4	5	
Job Analysis and Judgement	3	0	1	2	3	
Initiative	3	0	1	2	3	
Communication Skills	3	0	1	2	3	
Personality development	3	0	1	2	3	
Total	50	Total Score out of 50				

Guide lines for writing the Report:-

1. A Xerox copy of the training certificate issued by the industry.
2. Contents with page numbers.
3. Introduction of the Industry.
4. Organization structure.
5. Different Eqpt,/m/c/tools encountered: sketches/ photographs, specifications, applications.
6. Production processes employed
7. Safety measures observed.
8. Specific areas of Interest/ Assignments/ Projects undertaken.
9. Experiences gained.
10. List of figures/ graphs.
11. List of tables.
12. Acknowledgement.
13. References.

Note for trainees:- The selection of industry should be preferably outside Goa. The attendance should not be less than 75% of 24 weeks of the training period (working days only being considered). Absence due to sickness shall not be considered towards attendance.

Note for Inspection Authorities of the Institute:- Surprise visit at random shall be conducted by the Inspection Authorities (HOD and/or TPO) of the Institute at least once in a two month.

1. For Industrial training of Vth&VIIIth Semester Grades will be awarded based on marks scored as follows:

80% and above Marks – Grade 'A'
60% to 79% Marks – Grade 'B'
40% to 59% Marks – Grade 'C'
Marks below 40% - Grade 'D'

2. TW and PR/OR shall be separate heads of passing. Student has to secure minimum 'C' Grade for passing.