PROGRAMME CURRICULUM

AND

SYLLABI OF

DIPLOMA PROGRAMME IN

FABRICATION TECHNOLOGY & ERECTION ENGINEERING

UNDER RATIONALISED SEMESTER SYSTEM

(IMPLEMENTED FROM ACADEMIC YEAR 2020-2021)

BOARD OF TECHNICAL EDUCATION, GOA STATE

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SYLLABUS STRUCTURE FOR FABRICATION TECHNOLOGY & ERECTION ENGINEERING

DIPLOMA IN FABRICATION TECHNOLOGY & ERECTION ENGINEERING

(GC101) Communication Skills

1. COURSE OBJECTIVE :

The course aims to develop Communication skills in English by improving students' ability to write ,speak, listen and read effectively. Emphasis is also laid on students' personality development, helping them to build their confidence in interpersonal / group communication.

2. TEACHING AND EXAMINATION SCHEME

Semester	I								
Course code & course title		Periods/Week (in hours)			Total Hours	Examination Scheme			
						Theory Marks		Practical Marks		Total Marks
(GC101) Communication Skills		L	T	P	H	TH	TM	TW	PR/OR	
		-	-	02	32	-	-	25	25	50

3 . COURSE OUTCOMES:

On successful completion of the course, the student will be able to:

GC101.CO1 Understand the essentials of effective Communication.

GC101CO2 Develop reading. writing, speaking , listening and effective presentation skills.

GC101.CO3 Select the appropriate mode of Communication .

GC101.CO4 Demonstrate reading. writing, speaking , listening and effective presentation skills.

4.Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CO1	0	0	0	0	3	3	3
CO2	1	0	1	0	3	3	3
CO3	1	0	1	0	3	3	3
CO4	1	0	0	0	3	3	3

Relationship : Low-1 Medium-2 High-3

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	**Phr = Practical hours**	**CO = Course Outcomes**		
Unit		**M**	**Phr**	**CO**
1 UNIT NAME: FUNDAMENTALS OF COMMUNICATION SKILLS		**-**		
1.1 **Communication Skills fundamentals** Definition, communication process, importance of Communication Skills, essentials of effective communication			01	
1.2 **Types of communication**: verbal Communication and Nonverbal communication (Body language, facial expressions, gestures, eye contact, posture, dress and grooming/personal appearance, deportment, personal hygiene) Paralinguistic (Volume, pace, pitch, pauses)			02	**CO1** **CO2** **CO3** **CO4**
1.3 **Barriers to communication:** physical barriers, psychological barriers and cultural barriers			01	
2. Unit: PRESENTATION SKILLS				
2.1 Presentations: Methods and style of presentation, Importance, planning a presentation, venue selection, audience awareness (age, gender, profession background, educational and social background) time and duration, audio visual aids (OHP, LCD projector, flip charts, white/black/green board, computer, microphone)			**02**	**CO2** **CO3** **CO4**
2.2 Public speaking: preparatory steps, tips for good beginning and end, delivery style, techniques for a good speech (repetition, signs, pictures, humor), body language			**02**	
3 UNIT: TECHNICAL Writing				
3.1 Report **writing** Functions and parts of a report, Qualities of a good report, and types: Report on any institute function, Accident report, Industrial visit Report			04	**CO1** **CO2** **CO4**

3.**2 Business letters** Principles of effective letter writing, parts of a business letter, formats (Full block style, Semi block style, modified block style) Routine/ Generic letters (letter to the heads of the institute, letter to the heads of various departments/sections of the institute) Types of letters: Enquiry Letter, Quotation, Purchase Order, Letter of Complaint		06	
3.3 **Job application** Tips for a good C.V and a Resume		02	
4 UNIT GRAMMAR	-		
4.1 Fundamentals of English writing Subject verb agreement, homonyms, homophones, homographs, articles, Punctuation, synonyms, fundamentals of sentence construction		**02**	**CO1** **CO2** **CO4**
4.2 Paragraph Writing: Developing Topics (the main idea), body (supporting sentences), conclusion, proof reading		**02**	
UNIT V: LANGUAGE WORKSHOP **5.1 Reading Skills** strategies to use for building vocabulary and reading fluencies (read extensively, identify new words, use of dictionary, online dictionary apps), reading comprehension, pronunciation, debate, role play,	-	08	**CO1** **CO2** **CO4**
5.2 Listening Skills How to listen effectively, listening comprehension			
5.3 Speaking skills speech, group discussion			
5.4 Writing skills précis writing, comprehension			
Total		**32**	

6. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, videos, exercises

7. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	**Unit**	**NO of lectures**	**Marks**
1	Fundamental of Communications skills	04	-
2	Presentation Skills	04	-
3	Technical Writing	12	-
4	Grammar	04	-
5	Language workshop	08	-
	Total	32	25

8. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	**Practical**
1.	**Practical Title: Fundamental of Communications skills**
i.	Comprehension
ii.	Précis writing

iii.	Self-Introduction
2	**Practical Title: Presentation Skills**
iv.	Extempore speech
v.	Presentation on any given Topic
3	**Practical Title: Technical Writing**
vi.	Accident Report
vii.	Report on Institute function
viii.	Industrial visit report
ix.	Generic letters to the heads of various department/ Sections of the institute
x.	Inquiry letter
xi.	Quotation
xii.	Purchase or supply order
xiii.	Complaint letter
xiv.	Job application
4	**Grammar**
xv.	Exercises in subject – verb agreement
xvi.	Exercises in use of preposition
xvii.	Exercises in use of Homophones, homonyms, homographs
xviii.	Exercises in use of punctuation
xix.	Exercises relating to correcting the sentences
xx.	Paragraph writing
5	**Language workshop**
xxi.	Exercises to improve Reading skills
xxii.	Exercises to improve Writing skills
xxiii.	Group discussion
xxiv.	Listening comprehension

9. LEARNING RESOURCES

Text Books

S. No.	Author	Title of Books	Publishers
1	R. C. Sharma & Krishna Mohan	Business Correspondence and Technical Writing	Tata McGraw Hill
2	P. Prasad, Sharma, K. Rajendra	The Functional aspects of communication skills	S.k. Kataria& sons
3	SanjayKumar,Pushpa Lata	Communication Skills	Oxford University Press
4	A.K.Jain,A.M.Shaikh&Pravin S R Bhatia	Professional communication Skills	S.Chand
5	Wren & Martin	High School English Grammar & Composition	S. Chand, N. Delhi

10.Reference Books for further study

S. No.	Author	Title of Books	Publishers
1	Raul R. Timm	How to make winning presentations	Sneha Printers
2	Dale Carnegie, Training CPI	Stand and Deliver, How to become a masterful communicator and public speaker	Cox & Wyman, UK
3	John Seely	The Oxford Guide to Effective Writing and speaking	Oxford University Press

Autobiographies, self-help books, Audio speeches given by famous personalities

Internet and Web Resources

https://www.grammarly.com/
https://www.bbc.co.uk/programmes/articles/5QFnVy3xzT5htTh13cmP2P8/teacher-resources
https://Ted.com

Videos and Multimedia Tutorials

https://you.tu.be/AykYRO5d_II

(GC102) Engineering Mathematics I

1. COURSE OBJECTIVE:

1. The course is aimed at providing mathematical knowledge, developing computational skills and reasoning. It also helps students to think logically and in systematic manner so as to grasp mathematical concepts easily. It helps to build analytical thinking which play an important role in solving real world problems in all scientific discipline.

2.TEACHING AND EXAMINATION SCHEME

Semester	**I**							
Course code & course title		**Periods/Week (in hours)**			**Total hours**	**Examination Scheme**		
						Theory Marks	**Term Work**	**Total Marks**
(GC102) Engg.Maths I		**L**	**T**	**P**	**H**	**TH**	**TM**	**TW**	
		4	**2**	**-**	**96**	**75**	**25**	**25**	**125**

3.COURSE OUTCOMES:

GC102.CO1. Understand the basic mathematical concepts for Engineering applications.

GC102.CO2. Identify and use appropriate formulae for solving practical engineering problems

GC102.CO3. Apply formulae of algebra, geometry, trigonometry and calculus for solving problems.

GC102.CO4 . Co-relate mathematical formulae to practical problems.

4.Mapping Course Outcomes with Program Outcomes:

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**
CO1	**3**	**2**	**1**	**0**	**0**	**0**	**2**
CO2	**3**	**3**	**1**	**0**	**1**	**0**	**1**
CO3	**2**	**2**	**3**	**3**	**2**	**0**	**1**
CO4	**2**	**3**	**3**	**2**	**1**	**1**	**1**

Relationship :Low-1 Medium-2 High-3

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	**Thr = Teaching hours**	**CO = Course Objectives**	

Unit	**Marks**	**Thr**	**CO**
1 MATHEMATICS FUNDAMENTAL	**8**	**6**	**CO1**
1.1 **Polynomials: Types** of polynomials, addition subtraction, (no question to be asked), Multiplication and division of polynomials	3	2	
1.2 **: Algebraic equations:**Different types of equations and their geometric meaning(line,circle parabola only) ,equations with one, two and three variables and solving equations with two and three variables Quadratic equations and nature of their solutions	3	2	
1.3: Logarithm: Definition of log, log with base 'e' and base'10' Properties of log, log and antilog , problems using definition and properties of log.	2	2	
2.STRAIGHT LINES AND CIRCLES	15	14	**CO1, CO4**
2.1: Straight line: Intercept, slope, intersection of lines Equations of line: 1. Slope intercept form, slope point form, two points form, parallel and perpendicular lines, angle between lines Perpendicular distance of a point from line	8	7	
2.2: Circle: circle as a locus, Centre, diameter, chord of a circle Equations of circle: Centre radius form, diameter form, general form and sums	7	7	
3. TRIGONOMETRY			**CO1, CO3**
3.1: Angle and measurement, degree and radians and conversion and related sums, arc length and area of sector and sums **3.2:** Trigonometric ratios and identities 3.3: Trigonometric ratios of compound and allied angles 3.4: Product formulae sinA+sinB, cosA+cosB **3.5:** Sum and difference formulae **3.6:** Multiple angle 2A, and their trigonometric ratios, **3.7**: Sine rule, Cosine rule in triangle, solution of triangle	12	15	
4 : MENSURATION	10	6	**CO1,**

4.1: Areas of 2D figures like quadrilaterals, circle triangle etc (no questions to be asked) **4.2:** Surface area and volumes of cube, sphere, cylinder, cone, (no question to be asked) Surface areas and volumes of prism, pyramid, **4.3**: Frustum of cone, pyramid and their surface areas and volumes. **4.4:** Simpson's 1/3 rd rule for area and volume			**CO4**
5 :CALCULUS	30	23	**CO1, CO2, CO3, CO4**
5.1:Limits 5.1.1 : Pre requisite : Sets , intervals, relation and function (no questions to be asked) 5.1.2 : Limit of a function , algebraic properties of limits 5.1.3: Limits of algebraic, trigonometric, exponential, logarithmic functions	7	6	
5.2 : Derivatives 5.2 .1: Derivative definition by first principle (no question to be asked) 5.2.2: Standard formulae, Algebraic properties of derivative (u±v) etc. 5.2.3: Derivatives of algebraic, trigonometric, exponential, logarithmic functions 5.2.4: Derivative of product of functions (uv rule). 5.2.6: Derivative of quotient of functions (u/v rule) 5.2.7: Derivative of composite functions 5.2.8: Derivative of parametric functions 5.2.9: Derivative of implicit functions 5.2.10 : Logarithmic differentiations 5.2.11: Second order derivatives (no question to be asked)	15	12	
5.3 : Applications of derivatives 5.3.1: Application to the geometry: i) derivative as a slope of a tangent ii) to find equations of tangent and normal at given point on the curve 5.3.2: Application to the Linear motion:i) displacement, velocity,acceleration 5.3.3: Application to the rate measure i) to find rate change in area and volume etc 5.3.4 : Maxima and minima	8	5	
Total	**75**	**64**	

6. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises

7. SPECIFICATION TABLE FOR THEORY

Unit No	Unit	Number of lectures	Marks
1	**Mathematics Fundamental**	06	8
2	**Straight line and circle**	14	15
3	**Trigonometry**	15	12
4	**Mensuration**	06	10
5	**Calculus**	23	30
	Total	**64**	**75**

8. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

- Tutorial books should be maintained by students (5 marks)
- Two home assignments per semester (5 marks)

  The Two assignments each comprises of thirty questions which includes 15 short questions and fifteen long questions. First assignment will cover fifty percent of syllabus

  and second assignment will cover remaining portion of syllabus
- Topic-wise class assignment (15 marks)

  Class assignment comprises of ten short and ten long questions.

9. LEARNING RESOURCES

Text Books

S. No.	Title of Books	Author	Publishers
1	Mathematics for Polytechnic Students(Basic Mathematics)	S.P. Deshpande	Pune VidyarthiGrihaPrakashan 1786, Sadashiv Peth, Pune
2	Mathematics for Polytechnic Students(Engineering Mathematics)	S.P. Deshpande	Pune VidyarthiGrihaPrakashan 1786, Sadashiv Peth, Pune
3	S.B. Gore, M.B.Patil, S.P. Pawar	Applied Mathematics	Vrinda Publications

Reference Books for further study

S. No.	Title of Books	Author	Publishers
1	Applied Mathematics I	Dr. U.B.Jangam, K.P. Patil, Nalini Kumthekar	Nandu Printers& Publishers pvt. Ltd. Mumbai
2	Applied Mathematics for Polytechnics	H.K. Dass	CBS Publishers and distributers Pvt.Ltd. ,Pune
3	Set Theory and related topics	Seymour Lipschutz	McGraw-Hill

(GC103) APPLIED PHYSICS-I

1.COURSE OBJECTIVE :

On successful completion of the course, Students completing the Applied Physics I course will be able to demonstrate competency and understanding of the basic concepts found in, Units and Dimensions, Kinematics of motion in one dimension Force Work Power and Energy, Circular Motion and Gravitation, Properties of Matter and Heat and will be able to utilize the knowledge to demonstrate competency with experimental methods that are used to discover and verify the concepts related to content knowledge

2.TEACHING AND EXAMINATION SCHEME

Semester	I								
Course code & course title		Periods/Week (in hours)			Total Hours	Examination Scheme			
						Theory Marks		Practical Marks		Total Marks
(GC103) Applied Physics I		L	T	P	H	TH	TM	TW	PR/OR	
		03	0	02	80	75	25	25	-	125

3.COURSE OUTCOMES:

GC103.CO1: Understand the Fundamental concepts of physical quantities, Force, Power, Energy, Motion, Matter and heat transfer used in Engineering applications.

GC103.CO2: Explain the concepts of Dimensions, Work, Power , Energy ,Motion, properties of matter and heat transfer

GC103.CO3: Apply the Knowledge of Physical quantities, Types of motions, Force, work ,Power, properties of matter and heat transfer in Engineering applications

GC103. CO4: Analyze different types of Physical quantities, motions, properties of matter, and modes of heat transfer

4. Mapping Course Outcomes with Program Outcomes

Relationship: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific Knowledge	Problem Analysis	Design and Devlopment of Solutions	Engg. Tools, Experimentatn& Testing	Engg. Practices for Society,Sustainability& Environment	Project Management	Life -long Learning
CO 1	3	1	1	3	2	0	3
CO 2	3	1	2	3	0	0	3
CO 3	3	1	2	2	0	1	1
CO 4	1	1	2	2	0	1	1

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks | **Thr = Teaching hours** | **CO = Course Outcomes**			
Unit	**Thr**	**M**	**CO**
1 UNIT NAME: UNITS AND DIMENSIONS	**08**	**12**	**CO1, CO2, CO3, CO4**
1.1 Fundamental and Derived units ,			
1.2 Different system of units, SI unit conversion from one system to other,			
1.3 Principle of Homogeneity,			
1.4 Dimensions, dimensional formula,			
1.5 dimensonal correctness of given equation using dimensions			
1.6 least count of vernier calliper and screw gauge			
1.7 zero errors-- in case of vernier calliper and screw gauge			
1.8 Types of error.			
2. UNIT NAME: MOTION IN ONE DIMENSION, FORCE, WORK,POWER AND ENERGY	**10**	**16**	**CO1, CO2, CO3, CO4**
2.1 Distance and displacement,			
2.2 Scalar and Vectors			
2.3**,** Speed and Velocity, Uniform Velocity, ,			
2.4 Uniform acceleration,acceleration due to gravity			
2.5 Equation of motion ($v=u+at$, $v^2=u^2+2as$, $s=ut+1/2at^2$)(no derivation)			
2.6 Motion under gravity. Force and its unit.			
2.7 Work and its unit. Energy, law of conservation of energy,			
2.8. Kinetic and Potential energy equation and examples.			
3. UNIT NAME: Uniform Circular Motion and Gravitation	**10**	**16**	**CO1, CO2, CO3, CO4**
3.1 Unifrom circular motion,			
3.2 Definition angular displacement,angular velocity, ,			
3.3 Conversion from rpm to rad/sec,$v=r\omega$, tangential velocity, radial acceleration			
3.4 Centripetal force and centrifugal force, examples,			
3.5 Banking of roads,superelevation, expression for angle of banking			
3.6 Newtons law of gravitation, acceleration due to gravity ,			
3.7 Expression for acceleration due to gravity. Escape velocity, Critical velocity, and periodic time definition and expression (no derivation)			
3.8. Sattellite, types(Geosationary,communication remote sensing)			
4. UNIT NAME: PROPERTIES OF MATTER	**10**	**16**	**CO1, CO2, CO3, CO4**
4.1 Elasticity ,			
4.2 Stress, Strain,Hooke's law,			
4.3 Youngs Modulus,			
4.4 Bulk Modulus, Rigidity Modulus,			
4.5 Stress v/s Strain graph			
4.6 Yield point, breaking stress,factor of safety, ,			
4.7 Surface tension definition and example			
4.8. Adhesive and cohesive force, application,			
4.9 liquid miniscus and angle of contact, capillarity,			
4.10 Expression for surface tension (no derivation), applications. viscocity,			
4.11 Definition velocity gradient, newtons law of viscocity, terminal velocity,stokes law,			
4.12 Streamline flow and turbulent flow,critical velocity, application of viscocity.			

5. UNIT NAME: HEAT	**10**	**15**	**CO1, CO2, CO3, CO4**
5.1 Statements of boyles law,charles law,gay lussacs law			
5.2 General gas equation,specific heat definition and unit, Latent heat definition and unit			
5.3 Modes of transfer of heat, conduction, convection and radiation,			
5.4 Conduction of heat through a metall rod,			
5.5 Variable and Steady state			
5.6 law of thermal conductivity (With Derivation)			
5.7 Applications of thermal conductivity, ,			
5.8. Thermal expansion of solids			
5.9 linear expansion,superficial expansion,			
5.10 Cubical Expansion			
5.11 Realtion betwenn α,β,γ (no derivation)			
5.12 Engineering applications of expansion of solids.			

6. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies.

7. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	**Unit**	**Number of lectures**	**Marks**
1	UNITS AND DIMENSIONS	8	12
2	MOTION IN ONE DIMENSION, FORCE, WORK AND ENERGY	10	16
3	UNIFORM CIRCULAR MOTION AND GRAVITATION	10	16
4	PROPERTIES OF MATTER	10	16
5	HEAT	10	15
	Total	48	75

8. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS

No	**Practicals**	**Marks**
1.	Basic Conversion Techniques from one system of units to the other	25
2.	Use of Vernier callipers to find the Volume of Hollow cylinder, Block	25
3.	Use of Screw gauge to find the cross-sectional area of a wire and thickness of a clip	25
4.	To find the Coefficient of Viscosity of a given liquid by stokes method	25
5.	To Find the coefficient of Thermal Conductivity by Searle's Method	25
6	To Find the Surface Tension of a given liquid by capillary rise method	25
7	To Find Young's Modulus by Searles Method	25
8	To Find acceleration due to gravity by simple pendulum method.	25
	Total (Average)	25

9. LEARNING RESOURCES

Text Books

S. No.	Author	Title of Books	Publishers
1	B G Dhande	Applied Physics of Polytechnics	Pune Vidyarthi Griha Prakashan
2	Bhandarkar	Applied Physics of Polytechnics	Vrinda publication
3	R K Gaur and S L Gupta	Engineering Physics	Dhanpat Rai & Sons Delhi
4	Dr. Vasudev R Bhagwat	A Text Book of Applied Physics for Polytechnics	Broadway Publishing House
5	B L Thereja	Engineering Technology	S. Chand

Reference Books for further study

S. No.	Author	Title of Books	Publishers
1	Halliday D and Resnick	Physics Part I-II	Wiley Eastern Ltd.
2	Satish k. Gupta	ABC of Physics I&II	Modern Publisher
3	Saxena HC and Singh Prabhakar	Applied Physics Vol I & II	S. Chand Publisher

(GC104) Applied Chemistry

1. COURSE OBJECTIVE:

Chemistry is the branch of Science which deals with the study of composition, properties and changes in matter. An understanding of the basic concepts of Applied Chemistry, chemical principles and chemical properties of materials is essential to all the engineers. The emphasis is on applying the knowledge of principles of chemistry in all the fields of engineering wherein students appreciate the significance of chemistry in day to day life. The subject develops in students the habit of scientific enquiry, the ability to investigate cause and effect relationship & the ability to interpret & analyze the results.

2. TEACHING AND EXAMINATION SCHEME

Semester	**I**								
Course code & course title		**Periods/Week (in hours)**			**Total Credits (Hours)**	**Examination Scheme**			
						Theory Marks		**Practical Marks**		**Total Marks**
(GN104) Applied Chemistry		**L**	**T**	**P**	**H**	**TH**	**TM**	**TW**	**PR/OR**	
		3	**-**	**2**	**80**	**75**	**25**	**25**	**-**	**125**

3. COURSE OUTCOMES:

GC 104.CO1: Understand the fundamental concepts of Atomic Structure, electrochemistry, water quality, corrosion and polymers.

GC 104.CO2: Explain the process of Chemical bonding, water softening, electroplating, corrosion control and polymerization

GC 104.CO3: Relate the principles of Chemical Bonding, Electrolysis, water hardness for domestic and Industrial applications and properties of polymers.

GC 104.CO4: Distinguish between types of Chemical bonding, Water softening methods, corrosion control methods, different processes of metal coating and different polymers.

4. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific Knowledge	Problem Analysis	Design and Development of Solutions	Engg. Tools, Experimenting& Testing	Engg. Practices for Society, Sustainability & Environment	Project Management	Life -long Learning
CO1	3	2	1	1	2	1	1
CO2	2	3	2	1	3	1	2
CO3	3	2	2	2	3	1	2
CO4	3	2	2	2	2	1	1

Relationship : Low-1 Medium-2 High-3

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks | **Thr = Teaching hours** | **CO = Course Objectives**			
Unit	**Mks**	**Thr**	**CO**
UNIT 1.0 : ATOMIC STRUCTURE AND CHEMICAL BONDING	**15**	**10**	CO1 CO2 CO3 CO4
1.1 Atomic Structure 1.1.1 Fundamental particles and their characteristics. 1.1.2 Energy levels - Definition & designation 1.1.3 Sub Energy levels- Definition & designation 1.1.4 Orbital – Concept & shape (s and p only) **1.2** Quantum numbers 1.2.1 Designation, definition, values.			
1.3 Electronic distribution (Elements from atomic Number 1-20) 1.3.1 Bohr – Bury's laws for distribution of electrons in shells (1st three laws only) 1.3.2 Aufbau Principle. for distribution of electrons in sub-shells 1.3.3 Pauli's Exclusion Principle. 1.3.4 Hund's Rule of maximum multiplicity 1.3.5 Orbital Electronic Configuration of elements (from atomic numbers 1 to 20 only).			
1.4 Chemical Bonding 1.4.1 Lewis and Longmuir concept of stable configuration. 1.4.2 Electrovalent - Bond - Concept Formation of Electrovalent Compound (NaCL & MgO) 1.4.3 Covalent Bond – Concept Formation of Colvalent Compounds (Cl_2, O_2, N_2) 1.4.4 Co-ordinate Bond - Concept Formation of Co-ordinate Compounds (O_3) 1.4.5 Properties of Electrovalent, Colvalent & Co-Ordinate compounds.			
UNIT 2.0 : WATER	**15**	**10**	CO1 CO2 CO3 CO4
2.1 Hardness of Water 2.1.1 Soft and Hard Water - Concept Soap Test (Chemical Equation not expected) 2.1.2 Causes of Hardness 2.1.3 Types of Hardness 2.1.4 Degree of Hardness & Units of Hardness (mg/L & ppm)			
2.2 Disadvantages of Hard Water 2.2.1 Domestic Purpose Drinking, cooking, Washing & Bathing. 2.2.2 Industrial Purpose (Paper Industry, Textile & Dyeing Industry, Sugar Industry, Bakery & Concrete Making) 2.2.3 Boilers- Steam Generation Purpose.			

Sludge formation – causes & Disadvantages (No chemical equation expected)			
2.3 Water Softening 2.3.1 Zeolite and Ion Exchange process of water softening			
2.4 Desalination of water 2.4.1 Electrodialysis & Reverse Osmosis process. 2.4.2 pH- Concept, pH scale & Importance of pH			
UNIT 3.0 : <u>ELECTROCHEMISTRY</u>	**12**	**08**	CO1 CO2 CO3 CO4
3.1 Electrolytic dissociation 3.1.1 Arrhenius theory of Electrolytic dissociation 3.1.2 Factors affecting degree of Ionization- nature of solute, nature of solvent, concentration of solution and temperature.			
3.2 Electrolysis 3.2.1 Mechanism of Electrolysis. Ionization Reactions Reactions at cathode, Activity series of Cations. Reactions at Anode, Activity series of Anions. 3.2.2 Electrolysis of Molten NaCl using Carbon Electrodes. Aqueous NaCl using Platinum Electrodes. Aqueous $CuSO_4$ using Platinum Electrodes. Aqueous CuSO4 using copper Electrodes.			
3.3 Electrochemical series – Definition and Significance			
UNIT 4.0 : CORROSION AND ITS CONTROL	**25**	**14**	CO1 CO2 CO3 CO4
4.1 Dry /Direct Chemical corrosion 4.1.1 Definition 4.1.2 Oxidation corrosion 4.1.3 Corrosion due to other gases.			
4.3 Types of Electrochemical corrosion. 4.3.1 Galvanic Cell corrosion 4.3.2 Concentration cell corrosion(Metal ion concentration & differential Aeration)			
4.4 Corrosion Control Protection of metals by: 4.4.1. Using Pure Metals & Metal alloys 4.4.2 Proper designing 4.4.3 Modifying the environment (De- aeration, Deactivation, Dehumidification, Alkaline neutralization) 4.4.4 Cathodic protection (Sacrificial anode and Impressed current cathodic protection)			

4.4.5 Metal Coating (Galvanizing, Tinning, Metal-Spraying, Electroplating & powder coating)			
UNIT 5: POLYMERS	**08**	**06**	CO1 CO2 CO3 CO4
5.1 Concept of Monomers & Polymers **5.2**Polymerization- Definition. 5. 2.1 Addition polymerization-Definition. 5.2.2 General equation of polymerization of :- Ethylene to Polyethylene. Vinyl chloride to Polyvinylchloride Tetra fluoro ethylene to Poly tetra fluoroethylene(PTFE) 5.2.3 Condensation Polymerization-Definition 5.2.4 General Equation for formation of Phenol formaldehyde Resin. **5.3** Plastics. 5.3.1 Types of plastic (Thermosetting and Thermo softening), Examples 5.3.2 Properties and applications of Poly-ethylene, PVC, polystyrene, Nylons, Bakelite & silicones.			
5.4 Rubber 5.4.1 Natural Rubber 5.4.2 Drawbacks of Crude rubber. 5.4.3 Vulcanization of Rubber (General Equation) 5.4.4 Rubber examples. 5.4.5 Properties of Synthetic Rubber & related applications.			

8. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies

9. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	**ATOMIC STRUCTURE AND CHEMICAL BONDING**	10	15
2	**WATER**	10	15
3	**ELECTROCHEMISTRY**	08	12
4	**CORROSION & IT'S CONTROL**	14	25
5	**POLYMERS**	06	08
	Total	**48**	**75**

10. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	Practical
	Practical Title
1.	Double Acid-Base Titration using Phenolphthalein.
2.	Acid- Base titration using Methyl orange.
3.	Redox Titration of $KMnO_4$ soln., $FeSO_4$ soln. and Oxalic acid
4.	Determination of degree of Hardness by E.D.T.A method.
5.	Determination of Total Alkalinity of water sample.
6.	Determination of Chloride content of water sample by Mohr's method.
7.	pH- Metric titration.
8.	Conduct metric Titration.
9.	Determination of Conductivity of water samples from different water body sources.
10.	Corrosion Susceptibility of Aluminum to Acid or Base.
11.	Determination of pH of different food items.
	Total Marks: 25
	No Class room Assignments

*** Any TEN of the above.**

****Term Work Assessment Scheme**:1. Performance:15 marks (Carrying out experiment, Readings, Calculations and Results)
2.Knowledge :05 Marks(Theory of the experiment)
3. Journal : 05 Marks

11. LEARNING RESOURCES

Text Books

S. No.	Author	Title of Books	Publishers
1	M.M. Uppal	Text book of Engg. Chemistry	Khanna Publisher
2	V.P.Mehta	Text book of Engg. Chemistry	Jain Bros. Delhi
3	S.N Narkhede	Textbook of Engg. Chemistry	Niraj Prakashan
5	S S Dara	A Textbook of Engg. Chemistry	S Chand & Co
4	P.C. Jain and M.Jain	Engg. Chemistry.	Dhanpat Rai Publishing Co.

(GC105) Basic Engineering Practice (Electronics& Comp.)

1. COURSE OBJECTIVE:

The students will be able to acquire knowledge about safety aspects, firefighting, first-aid and carpentry, fitting, plumbing skills. The students will learn proper ways of using various hand tools, measuring devices in acquiring these skills and will also interpret simple electrical drawings/circuit diagrams.

2. TEACHING AND EXAMINATION SCHEME

Course Code & Course Title	Periods/ Week (In Hours)			Total Hours	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
(GC 106)	L	T	P	H	TH	TM	PR/OR	TW	
Basic Engineering Practice	0	0	5	80	-	-	50	100	150

3. COURSE OUTCOMES:

PART A

On successful completion of the course, the student will be able to:
GC106.CO1. Understand safety procedures to be followed in carpentry, fitting, and plumbing.
GC106.CO2. Identify various tools used for carpentry, fitting, and plumbing.
GC106.CO3: Demonstrate basic working skills in carpentry, fitting and plumbing.

GC106.CO4: Plan & execute a job/activity using job drawing.

PART B

On successful completion of the course, the student will be able to:
GC106.CO1. List the safety measures.to be observed in electrical workshop.
GC106.CO2. Identify various electrical tools, fittings used for electrical measurements & troubleshooting.
GC106.CO3: Distinguish between single phase and three phase supply.

GC106.CO4: Plan & execute a job/activity from electrical circuit drawing.

4. MAPPING COURSE OUTCOMES WITH PROGRAM OUTCOMES

PART A

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific Knowledge	Problem Analysis	Design and Development of Solutions	Engg. Tools, Experimentation& Testing	Engg. Practices for Society, Sustainability & Environment	Project Management	Life -long Learning
CO1	2	1	1	3	2	2	3
CO2	2	1	2	3	2	2	2
CO3	2	1	1	3	2	2	2
CO4	2	1	3	3	2	3	2

Relationship: Low-1 Medium-2 High-3

PART B

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific Knowledge	Problem Analysis	Design and Development of Solutions	Engg. Tools, Experimentation& Testing	Engg. Practices for Society, Sustainability & Environment	Project Management	Life -long Learning
CO1	2	1	1	3	2	2	3
CO2	2	1	2	3	2	2	2
CO3	3	1	1	2	2	1	2
CO4	2	1	3	3	2	3	2

Relationship: Low-1 Medium-2 High-

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks | **Hr = Practical Hours** | **CO = Course Outcomes**			
Unit	**M**	**Hr**	**CO**
1 General Safety, Housekeeping, Fire Fighting & First Aid	10	06	
1.1Introduction to General Safety aspects of engineering workshop 1.2 Meaning and importance of housekeeping. 1.3 Fire hazards, fire triangle, types of fire extinguishers – selection and use. 1.4Basic knowledge of first aid with specific inputs on cuts, burns, electric shocks, artificial respiration, handling emergencies.			CO1
2 Fitting Workshop Practice	30	18	
2.1 Introduction to the trade. 2.2 Introduction to various hand Tools, Measuring and Marking Tools, cutting tools, Holding tools, Striking tools 2.3 Types of files and filing methods. 2.4 Drill bits and drilling Processes, using portable and pillar drilling machine. 2.5 Operations performed in fitting shop such as measuring, marking, chipping, filing, grinding, sawing, drilling 2.6 Threading using taps and dies.			CO1 CO2 CO3
3 Carpentry Workshop Practice	20	18	
3.1 Introduction to carpentry 3.2 Types of wood and its characteristics, forms of wood, defects in timber and its identification, wood working hand tools 3.3 Wood working processes. 3.4 Different types of joints and their usage. 3.5 Introduction to wood working machines: 3.6 Lathe 3.7 Circular saw 3.8 Band saw 3.9 Wood planner 3.10 Universal wood working machine			CO1 CO2 CO3
4 Electrical Workshop Practice	30	32	
4.1 Brief introduction to power distribution and Electrical Safety. 4.2 Use of different hand tools used in electrical trade 4.3 Collection of details of motors and transformers. 4.4Introduction to Control Panel and its various sections/components. 4.5 Making of wire joints. 4.6Measurement of current, voltage, frequency and Power Consumption. 4.7 Connecting and starting of Induction Motor & Measurement of its speed. Changing of Direction of rotation of induction motor. 4.8 Introduction to commonly used electrical Fittings (Domestic & Industrial). 4.9Wiring of Simple Electric Circuit (Bulb & plug point and switches) on wooden board 4.10 Study, connection & use of Energy Meter 4.11Testing of components using Series test lamp & Multimeter 4.12Study of Fuses & practice replacement of Fuse			CO1 CO2 CO3 CO4

4.13 Study & Troubleshooting of Tube Light			
5 Plumbing	10	06	
5.1Plumbing tools, pipe fittings and method of joining pvc pipes. 5.2 Use of spirit level and plumb bob. 5.3 Minor repairs and replacement of fittings. 5.4 Reading of plumbing drawings. *[Note: Plumbing restricted to domestic plumbing and pvc piping.]*			CO1 CO2 CO3
Total	**100**	**80**	

6. COURSE DELIVERY:

The Course will be delivered through workshop practical sessions in mechanical and electrical workshops.

7. SPECIFICATION TABLE FOR PRACTICALS/ MACRO-LESSON PLAN

Unit No	Unit	Number of hrs.	Marks
1	General Safety, Housekeeping, Fire Fighting & First Aid	06	10
2	Fitting Workshop Practice	18	30
3	Carpentry Workshop Practice	18	20
4	Electrical Workshop Practice	32	30
5	Plumbing	06	10
	Total	80	100

8. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	Practical	Hrs.
1	**General Safety, Housekeeping, Fire Fighting & First Aid**	**06**
a	Demonstration on use of Safety Measures while working in Workshop and use of safety signs.	03
b	Demonstration on use of First Aid and Artificial Respiration procedure ,Training on fire and emergency services (using video presentation /fire and safety expert talk)	03
2	**Fitting Workshop Practice**	**18**
a	Identification of various hand Tools, Measuring and Marking Tools, cutting tools, Holding tools, Striking tools	03
b	Identification of various types of files and demonstration on filing methods.	03
c	Identification of various types of Drill bits, taps, dies and Drilling machines such as portable and Pillar Drilling machine.	03
d	Job involving filing, marking, cutting operation on MS Flat.	06
e	Job involving Drilling and Tapping operation on MS flat.	03
3	**Carpentry Workshop Practice**	**18**
a	Identification of various types of woods and wood working hand tools	03
b	Identification of various types of Carpentry joints and their usage.	03
c	Introduction to wood working machines such as wood working Lathe, Circular saw ,Band saw, Wood planner, Universal wood working machine	03
d	Job involving marking, measuring, planning, sawing, chiseling, joint preparation and assembly of wooden blocks.	06
e	Preparation of job on wood working lathe.	03
4	**Electrical Workshop Practice**	**32**
a	Measurement of Single Phase and Three Phase supply Voltage using	02

	multimeter.	
b	Identification of various hand tools used in electrical trade.	02
c	Measurement of electric circuit parameters using Ammeter, Voltmeter, Frequency meter, Wattmeter.	04
d	Making of Straight and T wire joints.	02
e	Testing of electrical components such as Choke, starter, Fuse, Switch using Series Test lamp and Multimeter	02
f	Starting of induction motor using DOL Starter	02
g	Reversal of direction of rotation of Three phase induction motor	02
h	Identification of commonly used electrical fittings.	02
i	Wiring of simple electrical circuit using bulb and socket.	04
j	Measurement of Energy using Energy Meter.	02
k	Identification of Different types of Fuses and their replacement in circuit.	02
l	Testing of various components and connection of Tube light circuit.	02
m	Collecting Name plate Details of Motors and Transformers and operating and controlling speed of motor from Control panel.	04
5	**Plumbing**	**06**
a	Identification of Plumbing tools and pipe fittings , Reading of plumbing drawings, methods of joining PVC pipes, use of spirit level and plumb bob in piping.	03
b	To carry out minor repairs and replacement of fittings.	03

9. LEARNING RESOURCES

TEXT BOOKS

S. No.	Author	Title of Books	Publishers
1	N. Sesha Prakash	Manual of Fire Safety	CBS Publishers and Distributers
2	S.K. Hajara-Chaudhary	Workshop Technology	Media Promoters
3	B.S. Raghuwanshi	Workshop Technology-	Dhanpat Rai and sons, New Delhi
4	R K Jain-	Production Technology	Khanna Publishers, New Delhi
5	H. S .Bawa	Workshop Technology	Tata McGraw Hill Publishers, New Delhi
6	Kent	Mechanical Engineering Hand book	John Wiley and Sons, New York
7	B.L. Theraja	Fundamentals of Electrical Engineering and Electronics	S. Chand – New Delhi

REFERENCE BOOKS FOR FURTHER STUDY

S. No.	Author	Title of Books	Publishers
1	CIMI- Central Instructional Media Institute Madras	Turner – Trade Theory – Ist and IInd Year	Wiley Eastern Ltd. New Delhi

(GC106) Basic Engineering Practice (Mech & Elect.)

1. COURSE OBJECTIVE:

The students will be able to acquire knowledge about safety aspects, firefighting, first-aid and carpentry, fitting, plumbing skills. The students will learn proper ways of using various hand tools, measuring devices in acquiring these skills and will also interpret simple electrical drawings/circuit diagrams.

2. TEACHING AND EXAMINATION SCHEME

Course Code & Course Title	Periods/ Week (In Hours)			Total Hours	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
(GC 106)	L	T	P	H	TH	TM	PR/OR	TW	
Basic Engineering Practice	0	0	5	80	-	-	50	75	125

3. COURSE OUTCOMES:

PART A

On successful completion of the course, the student will be able to:
GC106.CO1. Understand safety procedures to be followed in carpentry, fitting, and plumbing.
GC106.CO2. Identify various tools used for carpentry, fitting, and plumbing.
GC106.CO3: Demonstrate basic working skills in carpentry, fitting and plumbing.

GC106.CO4: Plan & execute a job/activity using job drawing.

PART B

On successful completion of the course, the student will be able to:
GC106.CO1. List the safety measures.to be observed in electrical workshop.
GC106.CO2. Identify various electrical tools, fittings used for electrical measurements & troubleshooting.
GC106.CO3: Distinguish between single phase and three phase supply.

GC106.CO4: Plan & execute a job/activity from electrical circuit drawing.

4. MAPPING COURSE OUTCOMES WITH PROGRAM OUTCOMES

PART A

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific Knowledge	Problem Analysis	Design and Development of Solutions	Engg. Tools, Experimentation& Testing	Engg. Practices for Society, Sustainability & Environment	Project Management	Life -long Learning
CO1	2	1	1	3	2	2	3
CO2	2	1	2	3	2	2	2
CO3	2	1	1	3	2	2	2
CO4	2	1	3	3	2	3	2

Relationship: Low-1 Medium-2 High-3

PART B

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific Knowledge	Problem Analysis	Design and Development of Solutions	Engg. Tools, Experimentation& Testing	Engg. Practices for Society, Sustainability & Environment	Project Management	Life -long Learning
CO1	2	1	1	3	2	2	3
CO2	2	1	2	3	2	2	2
CO3	3	1	1	2	2	1	2
CO4	2	1	3	3	2	3	2

Relationship: Low-1 Medium-2 High-

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks | **Hr = Practical Hours** | **CO = Course Outcomes**			
Unit	**M**	**Hr**	**CO**
1 General Safety, Housekeeping, Fire Fighting & First Aid		06	
1.1Introduction to General Safety aspects of engineering workshop 1.2 Meaning and importance of housekeeping. 1.3 Fire hazards, fire triangle, types of fire extinguishers – selection and use. 1.4Basic knowledge of first aid with specific inputs on cuts, burns, electric shocks, artificial respiration, handling emergencies.			CO1
2 Fitting Workshop Practice		18	
2.7 Introduction to the trade. 2.8 Introduction to various hand Tools, Measuring and Marking Tools, cutting tools, Holding tools, Striking tools 2.9 Types of files and filing methods. 2.10 Drill bits and drilling Processes, using portable and pillar drilling machine. 2.11 Operations performed in fitting shop such as measuring, marking, chipping, filing, grinding, sawing, drilling 2.12 Threading using taps and dies.			CO1 CO2 CO3
3 Carpentry Workshop Practice	20	18	
3.10 Introduction to carpentry 3.11Types of wood and its characteristics, forms of wood, defects in timber and its identification, wood working hand tools 3.12 Wood working processes. 3.13 Different types of joints and their usage. 3.14 Introduction to wood working machines: a. Lathe b. Circular saw c. Band saw d. Wood planner e. Universal wood working machine			CO1 CO2 CO3
4 Electrical Workshop Practice	30	32	
4.1 Brief introduction to power distribution and Electrical Safety. 4.2 Use of different hand tools used in electrical trade 4.3 Collection of details of motors and transformers. 4.4 Introduction to Control Panel and its various sections/components. 4.5 Making of wire joints. 4.6Measurement of current, voltage, frequency and Power Consumption. 4.7 Connecting and starting of Induction Motor & Measurement of its speed. Changing of Direction of rotation of induction motor. 4.8 Introduction to commonly used electrical Fittings (Domestic & Industrial). 4.9Wiring of Simple Electric Circuit (Bulb & plug point and switches) on wooden board 4.10 Study, connection & use of Energy Meter 4.11Testing of components using Series test lamp & Multimeter			CO1 CO2 CO3 CO4

4.12Study of Fuses & practice replacement of Fuse 4.13 Study & Troubleshooting of Tube Light			
5 Plumbing		06	
5.1 Plumbing tools, pipe fittings and method of joining pvc pipes. 5.2 Use of spirit level and plumb bob. 5.3 Minor repairs and replacement of fittings. 5.4 Reading of plumbing drawings. *[Note: Plumbing restricted to domestic plumbing and pvc piping.]*			CO1 CO2 CO3
Total		**80**	

6. COURSE DELIVERY:

The Course will be delivered through workshop practical sessions in mechanical and electrical workshops.

7. SPECIFICATION TABLE FOR PRACTICALS/ MACRO-LESSON PLAN

Unit No	Unit	Number of hrs.	Marks
1	General Safety, Housekeeping, Fire Fighting & First Aid		10
2	Fitting Workshop Practice		30
3	Carpentry Workshop Practice		20
4	Electrical Workshop Practice		30
5	Plumbing		10
	Total		100

8. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	Practical	Hrs.
1	**General Safety, Housekeeping, Fire Fighting & First Aid**	**06**
a	Demonstration on use of Safety Measures while working in Workshop and use of safety signs.	03
b	Demonstration on use of First Aid and Artificial Respiration procedure ,Training on fire and emergency services (using video presentation /fire and safety expert talk)	03
2	**Fitting Workshop Practice**	**18**
a	Identification of various hand Tools, Measuring and Marking Tools, cutting tools, Holding tools, Striking tools	03
b	Identification of various types of files and demonstration on filing methods.	03
c	Identification of various types of Drill bits, taps, dies and Drilling machines such as portable and Pillar Drilling machine.	03
d	Job involving filing, marking, cutting operation on MS Flat.	06
e	Job involving Drilling and Tapping operation on MS flat.	03
3	**Carpentry Workshop Practice**	**18**
a	Identification of various types of woods and wood working hand tools	03
b	Identification of various types of Carpentry joints and their usage.	03
c	Introduction to wood working machines such as wood working Lathe, Circular saw ,Band saw, Wood planner, Universal wood working machine	03
d	Job involving marking, measuring, planning, sawing, chiseling, joint preparation and assembly of wooden blocks.	06

e	Preparation of job on wood working lathe.	03
4	**Electrical Workshop Practice**	**32**
a	Measurement of Single Phase and Three Phase supply Voltage using multimeter.	02
b	Identification of various hand tools used in electrical trade.	02
c	Measurement of electric circuit parameters using Ammeter, Voltmeter, Frequency meter, Wattmeter.	04
d	Making of Straight and T wire joints.	02
e	Testing of electrical components such as Choke, starter, Fuse, Switch using Series Test lamp and Multimeter	02
f	Starting of induction motor using DOL Starter	02
g	Reversal of direction of rotation of Three phase induction motor	02
h	Identification of commonly used electrical fittings.	02
i	Wiring of simple electrical circuit using bulb and socket.	04
j	Measurement of Energy using Energy Meter.	02
k	Identification of Different types of Fuses and their replacement in circuit.	02
l	Testing of various components and connection of Tube light circuit.	02
m	Collecting Name plate Details of Motors and Transformers and operating and controlling speed of motor from Control panel.	04
5	**Plumbing**	**06**
a	Identification of Plumbing tools and pipe fittings , Reading of plumbing drawings, methods of joining PVC pipes, use of spirit level and plumb bob in piping.	03
b	To carry out minor repairs and replacement of fittings.	03

9. LEARNING RESOURCES

TEXT BOOKS

S. No.	Author	Title of Books	Publishers
1	N. Sesha Prakash	Manual of Fire Safety	CBS Publishers and Distributers
2	S.K. Hajara-Chaudhary	Workshop Technology	Media Promoters
3	B.S. Raghuwanshi	Workshop Technology-	Dhanpat Rai and sons, New Delhi
4	R K Jain-	Production Technology	Khanna Publishers, New Delhi
5	H. S .Bawa	Workshop Technology	Tata McGraw Hill Publishers, New Delhi
6	Kent	Mechanical Engineering Hand book	John Wiley and Sons, New York
7	B.L. Theraja	Fundamentals of Electrical Engineering and Electronics	S. Chand – New Delhi

REFERENCE BOOKS FOR FURTHER STUDY

S. No.	Author	Title of Books	Publishers
1	CIMI- Central Instructional Media Institute Madras	Turner – Trade Theory – Ist and IInd Year	Wiley Eastern Ltd. New Delhi

(GC201) ENGINEERING MATHEMATICS II

1. COURSE OBJECTIVE:

The course is aimed at providing mathematical knowledge, developing computational skills and reasoning. It also helps students to think logically and in systematic manner so as to grasp mathematical concepts easily. It helps to build analytical thinking which play an important role in solving real world problems in all scientific discipline.

2. TEACHING AND EXAMINATION SCHEME

Semester	**II**								
Course code & course title		**Periods/Week (in hours)**			**Total hours**	**Examination Scheme**			
						Theory Marks		**TERM WORK**	**Total Marks**
(GC201) Engineering Mathematics II		**L**	**T**	**P**	**H**	**TH**	**TM**	**TW**	**PR/OR**
		4	**2**	**-**	**96**	**75**	**25**	**25**	**-**

3.COURSE OUTCOMES:

GC201.CO1: Understand the basic principles of Matrices ,Integration, Determinants and Vectors in engineering problems.
GC201.CO2: Interpret the formulae to solve problems of Matrices ,Integration, Determinants and Vectors.
GC201.CO3: Apply appropriate mathematical methods for solving engineering problems.
GC201.CO4: Analyse the knowledge of Matrices ,Integration, Determinants and Vectors for various Engineering applications.

4. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CO1	3	1	1	2	0	2	2
CO2	3	1	1	2	0	2	2
CO3	2	2	2	3	1	2	2
CO4	1	3	2	3	1	2	2

Relationship : Low-1 Medium-2 High-3

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	**Thr = Teaching hours**	**CO = Course Objectives**			
Unit			**Marks**	**Thr**	**CO**
1 .DETERMINANTS AND MATRICES			**15**	**12**	**CO1, CO2, CO4**
1.1 **Determinants**: Definition & order of determinant, value of determinant, properties of determinants(no question), Cramer's rule for solving equations with two & three variables			7	4	
1.2 **Matrices**: - Definition & order of matrix, types of matrices, Equality of matrices, addition & subtraction, multiplication of matrices, adjoint & inverse of a matrix , solution of linear equations with two & three variables using matrices			8	8	
2 .INTEGRATION			20	22	**CO1, CO2, CO4**
Definition, Standard Formulae, properties of Integration for sum, difference and scalar multiplication, integration of algebraic, trigonometric, inverse trigonometric, exponential, logarithmic, composite function, Integration by substitution, integration by partial fraction, integration by parts					
3 .DEFINITE INTEGRALS			10	08	**CO3**
Definition of definite integral and Properties of definite integral ,integration by parts Applications:Area under the curves & lines and area between the curves and Volumes (simple problems)					
4 .VECTORS			15	12	**CO1, CO2, CO4**
Definition of scalars & vectors, equality of vectors, Addition & subtraction of vectors, triangle, parallelogram laws for addition, position vector, dot product & cross product and their properties and applications, relation between dot and cross product and scalar triple product and applications					
5 .STATISTICS / COMPLEX NUMBERS			15	10	**CO3**
Statistics : **(ME and Allied courses only)** 5.1:Measures of central Tendency -mean, median, mode for ungrouped & grouped data 5.2:Measures of dispersion –Range, mean deviation, standard deviation, variance, coefficient of variation 5.3: Corrected mean and relation between standard deviation and mean.					

5.Complex Numbers (electronics and Allied courses only) 5.1:Definition of complex number and Argand diagram, equality of complex numbers, 5.2:powers of 'i' ,complex conjugates, 5.3:Addition& subtraction of complex nos. Multiplication& division of complex nos. 5.4: Modulus and argument of a complex number 5.5:Polar form & exponential form of complex no. 5.6: De Moivre's theorem., nth root of complex nos. 5.7:Hyperbolic, exponential, circular functions			**CO3**
Total	**75**	**64**	

6. COURSE DELIVERY:
The Course will be delivered through lectures, class room interactions, exercises and case studies

7. SPECIFICATION TABLE FOR THEORY (GC201)

Unit No	**Unit**	**Number of lectures**	**Marks**
1	**Determinants & Matrices**	12	15
2	**Integration**	22	20
3	**Definite Integrals**	08	10
4	**Vectors**	12	15
5	**Statistics /Complex Number**	10	15
	Total	**64**	**75**

- Tutorial books should be maintained by students (5 marks)
- Two home assignments per semester (5 marks)

  The Two assignments each comprises of thirty questions which includes 15 short questions and fifteen long questions. First assignment will cover fifty percent of syllabus

  and second assignment will cover remaining portion of syllabus
- Topic-wise class assignment (15 marks)

  Class assignment comprises of ten short and ten long questions.

9. LEARNING RESOURCES

Text Books /reference books

S. No.	Title of Books	Author	Publishers
1	Mathematics for Polytechnic Students(Basic Mathematics)	S.P. Deshpande	Pune VidyarthiGrihaPrakashan 1786, Sadashiv Peth, Pune
2	Mathematics for Polytechnic Students(Engineering Mathematics)	S.P. Deshpande	Pune VidyarthiGrihaPrakashan 1786, Sadashiv Peth, Pune
3	Applied Mathematics	S.B. Gore, M.B.Patil, S.P. Pawar	Vrinda Publications

Reference Books for further study

S. No.	Title of Books	Author	Publishers
1	Applied Mathematics I	Dr. U.B.Jangam, K.P. Patil, Nalini Kumthekar	Nandu Printers& Publishers Pvt. Ltd. Mumbai
2	Applied Mathematics for Polytechnics	H.K. Dass	CBS Publishers & Distributers Pvt. Ltd. Pune
3	Advanced Engineering mathematics	H.K. Dass	S. Chand

(GC 202) APPLIED PHYSICS- II

1. COURSE OBJECTIVE:

On successful completion of the course, Students completing the Applied Physics II course will be able to demonstrate competency and understanding of the basic concepts found in, Electrostatics, Current Electricity, Electromagnetism and Electromagnetic Induction, Light and Optics and Sound, and will be able to utilize the knowledge to demonstrate competency with experimental methods that are used to discover and verify the concepts related to content knowledge.

2.TEACHING AND EXAMINATION SCHEME

Semester	**II**								
Course code & course title		**Periods/Week (in hours)**			**Total Hours**	**Examination Scheme**			
						Theory Marks		**Practical Marks**		**Total Marks**
(GC202) Applied Physics- II		**L**	**T**	**P**	**H**	**TH**	**TM**	**TW**	**PR/OR**	
		03	**0**	**02**	**80**	**75**	**25**	**25**	**-**	**125**

3. COURSE OUTCOMES:

GC202.CO1: Understand the Fundamental Concepts of Electrostatics, Current Electricity, Electromagnetism and Electromagnetic Induction, Light, Optics and Sound.
GC202.CO2: Explain the basic principles of Electrostatics, Current Electricity, Electromagnetism and Electro Magnetic Induction, Light , Optics and sound.
GC202.CO3: Apply the knowledge of Electrostatics, Current Electricity, Electromagnetism and Electromagnetic Induction, Light, Optics and Sound to specific applications.
GC202.CO4: Compute various parameters in the field of Electrostatics, Current Electricity, Electromagnetism and Electromagnetic Induction, Light, Optics and Sound.

4. Mapping Course Outcomes with Program Outcomes

Relationship : 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific Knowledge	**Problem Analysis**	**Design and Devlopment of Solutions**	**Engg. Tools, Experimentatn & Testing**	**Engg. Practices for Society,Sustain ability& Environment**	**Project Management**	**Life -long Learning**
CO 1	3	3	1	1	2	0	3
CO 2	3	3	1	1	2	0	2
CO 3	3	2	3	3	3	1	1
CO 4	2	2	2	3	1	1	1

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks | **Thr = Teaching hours** | **CO = Course Objectives**			
Unit	**M**	**Thr**	**CO**
1 UNIT NAME: ELECTROSTATICS	**12**	**8**	**CO1, CO2, CO3, CO4**
1.1 Coulomb's law, Electric field,			
1.2 Electric field Intensity, Electric lines of force and properties			
1.3 Electric potential, Definition of Absolute potential			
1.4, Potential difference, Potential of sphere,			
1.5 Potential of earth.			
1.6 Capacitance,			
1.7 Capacitors in Parallel Derivation of Expression			
1.8. Capacitor in series Derivation Of Expression			
2. UNIT NAME: CURRENT ELECTRICITY	**20**	**12**	**CO1, CO2, CO3, CO4**
2.1 Definition of Electric Current and its Unit, Ohm's Law, Resistance,			
2.2 Factors on which resistance depends, Specific resistance. Effect of temperature on resistance Temperature coefficient of resistance,			
2.3 Resistances in Series and parallel			
2.4 EMF and Internal resistance of cell			
2.5 General Equation of ohm's law.			
2.6. Wheatstone's Network and Principle of Meter Bridge			
2.7 Principle of Potentiometer (Vα L) and Applications to compare EMF of given cells by single cell method and sum difference method			
2.8 Determination of Internal resistance of a cell using potentiometer.			
2.9 Electric Power and Electric Energy, KWh			
2.10 Calculation of Energy bills			
2.11 Heating Effect of Electric current. Joule's law.			
2.12 Applications in house hold appliances			
3. **UNIT NAME: ELECTROMAGNETISM AND EM INDUCTION**	**16**	**10**	**CO1, CO2, CO3, CO4**
3.1 Magnet, Magnetic field, Magnetic flux, and magnetic flux density and its unit			
3.2 Magnetic effect of Current, Oersted's Experiment, Right hand Thumb Rule, Biot Savart law			
3.3 Magnetic field at the center of the coil (no derivation), Magnetic field due to coil (Qualitative discussion only			
3.4 Electromagnet. Force acting on a current carrying conductor placed in magnetic field and expression (no derivation)			
3.5 Fleming's left-hand rule. Electromagnetic Induction. Faraday's Experiment			
3.6. Faraday's laws Lenz's law. Self-Induction and Mutual Induction.			
3.7 Transformer Principle.			
3.8 Step up and Step-down transformer.			
3.9 Induction Heating			
3.10 Induction heater and uses			
4. **UNIT NAME: LIGHT AND OPTICS**	**16**	**10**	**CO1, CO2, CO3,**
4.1 Frequency Range of Infrared, ultraviolet and visible light and their uses			
4.2 Reflection, Refraction, Snell's law, refractive index.			

4.3 Refraction through glass slab and prism.			**CO4**
4.4 Total Internal reflection applications in optical fibers.			
4.5 Advantages of optical fibers. LASER, sources and applications.			
4.6. Luminous Intensity, Intensity of Illumination			
4.7 Inverse square law of Illumination (No derivation)			
4.8 Principle of Photometry, X rays,			
4.9 Production of X Rays by Coolidge tube			
4.10 Properties and applications			
5. **UNIT NAME: SOUND**	**11**	**08**	**CO1, CO2, CO3, CO4**
5.1 Sound as longitudinal wave,wavelength,frequency,time period, amplitude,			
5.2 Free vibration force vibration,resonance, examples,			
5.3 Echo reverberation ,pitch loudeness,intensity of sound,			
5.4 Ultrasonic waves, Piezo electric effect, Principle of Production of ultra-sonics waves			
5.5 Application of Ultra sonics in finding depth of sea,			
5.6. Detection of flaws in metal, soldering, Drilling,			
5.7 Ultrasonic Cleaning			
5.8Ultrasound for medical purposes.(Just Uses)			

6. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies

7. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	ELECTROSTATICS	8	12
2	CURRENT ELECTRICITY	12	20
3	ELECTROMAGNETISM AND EM INDUCTION	10	16
4	LIGHT AND OPTICS	10	16
5	SOUND	8	11
	Total	48	75

8. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS

No	Practicals	Marks
1.	Specific Resistance by Ammeter Voltmeter Method	25
2	Specific Resistance by Meter Bridge Method	25
3	To Verify the Series Law of Resistance by Meter Bridge Method	25
4	To Verify the Parallel Law of Resistance by Meter Bridge Method	25
5	To Compare the emf of two cells by single cell method	25
6	To find the internal resistance of a cell by Potentiometer Method	25
7	To find the velocity of sound by Resonance Tube method	25
8	To find the Refractive index	25
	Total (Average)	25

9. LEARNING RESOURCES

Text Books

S. No.	Author	Title of Books	Publishers
1	B G Dhande	Applied Physics of Polytechnics	Pune Vidyarthi Griha Prakashan
2	Bhandarkar	Applied Physics of Polytechnics	Vrinda publication

3	R K Gaur and S L Gupta	Engineering Physics	Dhanpat Rai & Sons Delhi
4	Dr. Vasudev R Bhagwat	A Text Book of Applied Physics for Polytechnics	Broadway Publishing House
5	B L Thereja	Engineering Technology	S. Chand

Reference Books for further study

S. No.	Author	Title of Books	Publishers
1	Halliday D and Resnick	Physics Part I-II	Wiley Eastern Ltd.
2	Satish k. Gupta	ABC of Physics I&II	Modern Publisher
3	Saxena HC and Singh Prabhakar	Applied Physics Vol I & II	S. Chand Publisher

(GC203) ENVIRONMENTAL STUDIES

1. COURSE OBJECTIVE:

Environment is the nurturing force upon which we depend. It decides our well being, our health & quality of our life. The environment is deteriorating at an alarming rate due to increasing human activity and can be saved only by timely human action. The aim of Environmental studies is to sensitize the students towards the need to conserve & protect natural resources & biological support systems. With the aim to develop an attitude of concern for the environment the students will learn to choose environmentally friendly options for sustainable development and live in harmony with nature.

2. TEACHING AND EXAMINATION SCHEME :

Semester	**I**								
Course code & course title		**Periods/Week (in hours)**			**Total Credits**	**Examination Scheme**			
						Theory Marks		**Practical Marks**		**Total Marks**
(GC203) Environmental Studies		**L**	**T**	**P**	**H**	**TH**	**TM**	**TW**	**PR/OR**	
		04	**-**	**-**	**64**	**75**	**25**	**-**	**-**	**100**

3. COURSE OUTCOMES:

GC203.CO1: Understand the role and importance of various elements of Environment.

GC203.CO2: Identify the concerns related to the natural resources, ecosystems, biodiversity, pollution and social issues of environment.

GC203.CO3: Develop sensitivity towards Environmental issues.

GC203.CO4: Co-relate causes affecting the environment & biodiversity.

4. Mapping Course Outcomes with Program Outcomes :

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific Knowledge	Problem Analysis	Design and Devlopment of Solutions	Engg. Tools, Experimenta	Engg. Practices for Society,Sustainability	Project Management	Life -long Learning
CO1	2	1	1	0	3	2	2
CO2	2	1	1	0	3	2	2
CO3	1	1	1	0	3	2	2
CO4	1	1	2	0	3	2	2

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks | **Thr = Teaching hours** | **CO = Course Objectives**			
Unit	**Mks**	**Thr**	**CO1, CO3, CO4**
UNIT 1.0 : Multidisciplinary Nature of Environmental Studies	**09**	**08**	
1.1 Environmental studies : Definition , Scope and Importance			
1.2 Need for Public Awareness			
1.3 Environment & Human Health			
1.4 Environmental Ethics			
1.5 Value Education			
1.6 From Unsustainable to Sustainable Development : Concept and Guidelines			
1.7 Concept of Environmental Audit (EA) Environment Impact Assessment (EIA)			
1.8 Ecological Foot Prints			
UNIT 2.0 : ECOSYSTEM AND BIODIVERSITY	**15**	**13**	**CO1, CO2, CO3, CO4**
2.1 Ecosystem 2.1.1Concept, Structure & functions of ecosystem (Function of producer, consumer and decomposer) 2.1.2 Food chain & Food web- Concept & Examples 2.1.3 Energy flow in Ecosystem 2.1.4 Ecological Pyramids (Inverted & Upright) Pyramid of Number, Biomass & Energy. 2.1.5 Ecological Succession (Primary & Secondary Succession) 2.1.6 Study of Ecosystem: characteristic features structure and functions) Terrestrial(Forest, Grassland, Desert) Aquatic(Pond, River & Ocean)			
2.2 Biodiversity 2.2.1 Definition of Biodiversity 2.2.2. Types of Diversity (Genetic, Species & Ecosystem) 2.2.3. Value of Biodiversity (Consumptive , Productive, Social ,Aesthetic Moral & Optional value) 2.2.4 India as a Mega- diversity Nation 2.2.5 Biogeographical classification of India 2.2.6 Extinct, Endangered, Threatened & Endemic Species -Examples (of India) 2.2.7 Threats to Biodiversity (Habitat loss, Poaching of Wild life & Man Wildlife Conflict) 2.2.8 Reasons for loss of Biodiversity 2.2.9 Conservation of Biodiversity (Insitu & Exsitu conservation)			
UNIT 3.0 : NATURAL RESOURCES	**18**	**15**	**CO1, CO2, CO3, CO4**
3.1 Forest Resource 3.1.1 Direct & Indirect value of Forest 3.1.2 Deforestation-causes & effects 3.1.3 Forest Management **3.2** Water Resource			

3.2.1 Water as a scarce Resourc 3.2.2Use and over exploitation of surface and ground water 3.2.3 Need for Water Conservation 3.2.4 Construction of dams- Benefits and draw backs (Rehabilitation & Resettlement of people) 3.2.5 Rain water Harvesting. 3.2.6 Watershed Management 3.2.7 Conflicts over water in India **3.3** Energy Resource 3.3.1 Renewable & Non-Renewable sources of Energy 3.3.2 Growing Energy Needs. 3.3.3 Alternate Source of Energy (Solar ,Wind, Bio, Geothermal, Hydro & Nuclear Energy)			
3.4 Food Resource 3.4.1 Sources of Food 3.4.2 World Food Problems (Undernourishment & Malnourishment) 3.4.3 Changes caused by agriculture & overgrazing 3.4.5 Effects of modern agriculture on environment (use of synthetic fertilizers & synthetic pesticides in agriculture) **3.5** Mineral Resource 3.5.1 Types of Minerals 3.5.2 Use & Overexploitation of Minerals 3.5.3 Environmental Impact of Mining. **3.6** Land Resource 3.6.1 Pattern of Land Utilization (In India and World) 3.6.2 Land Degradation – Causes & Control Measures			
UNIT 4.0 : ENVIRONMENTAL POLLUTION- Sources , Effects & Control Measures	**24**	**20**	
4.1 Air Pollution 4.1.1 Definition, sources of air pollution(Primary and Secondary air pollutants with examples) 4.1.2 Effects on human health, animals, plants & Materials 4.1.3 Control of Air Pollution. 4.1.4 Removal of Particulate matter 4.1.5 Principles & Application of Control Equipments (Gravity and Inertial Separators, Cyclones, Filters, Electrostatic precipitators, Wet scrubbers) 4.1.6 Removal of Gaseous Pollutants (Combustion, Adsorption, Absorption) 4.1.7 Global Issues Definition, Cause & effects of Green House effect & Global Warming. Ozone layer Depletion, Acid Rain.			**CO1, CO2, CO3, CO4**
4.6 Noise Pollution :-			

4.6.1 Definition. 4.6.2 Sources of Noise Pollution 4.6.3 Effects of Noise Pollution on Human health (Noise Induced hearing loss, Physiological & Psychological Effects) 4.6.4 Control of Noise Pollution.			
4.7. Nuclear Pollution / Radioactive Pollution:- 4.7.1 Definition 4.7.2. Sources of nuclear Pollution (Natural & Man made) 4.7.3. Effects of Nuclear Pollution 4.7.4. Control of Nuclear Pollution 4.7.5.Disposal of Nuclear waste (Low, Medium & High activity waste) 4.7.6 Nuclear Accidents & Holocaust – case study			
4.8 Solid Waste Pollution. Definition: Refuse, Garbage Sources of Solid waste Types of solid waste (MSW, HW, BMW & EW) Effects of Consumerism Segregation of Solid waste at source Treatment of MSW (Open dumping, Land filling, incineration & composting) Waste Utilization (Reuse, Reclaim & Recycle) Solid waste Management System – Flow sheet diagram **4.9** Role of an Individual in Prevention of Pollution.			
UNIT 5.0 : SOCIAL ISSUES & ENVIRONMENT	**09**	**08**	**CO2, CO3, CO4**
5.1 Environmental Legislation Article 47 & Article 51-A(g)of the constitution on Environment. 5.1.1 Protection Functions of Ministry of Environment and Forest Govt. of India Objectives & Functions of Central & state pollution Control Boards Environmental Protection Act. Air (Prevention & Control of Pollution) Act. Water (Preventation & Control of Pollution) Act. Wildlife Protection Act. Forest Conservation Act. Motor vehicle Act.			
5.2 Social Issues 5.2.1Women & Child Welfare 5.2.2 Role of IT in Environment & Human Health 5.2.3 AIDS 5.2.4 Population Growth & Variation among Nations 5.2.5 Human Rights			

6. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies

7. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	**MULTI-DISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES**	08	09
2	**ECOSYSTEM AND BIODIVERSITY**	13	15
3	**NATURAL RESOURCES**	15	18
4	**ENVIRONMENTAL POLLUTION**	20	24
5	**SOCIAL ISSUES & ENVIRONMENT**	08	09
	Total	64	75

8. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

9. LEARNING RESOURCES

Text Books

S. No.	Author	Title of Books	Publishers
1	Erach Bharucha	Textbook of Environmental Studies	Universities Press (India) Private Ltd.
2	Dr. Suresh K. Dhameja	Environmental studies	S.K. Kataria & Sons
3	Y. Anjaneyulu	Introduction to Environmental Science	B.S Publications
4	S. Deswal & A. Deswal	A Basic Cource in Environmental Studies	Dhanpat Rai & Co.
5	P. Meenakshi	Elements of Environmental Science and Engineering	Prentice Hall of India (PHI)

Reference Books for further study

S. No.	Author	Title of Books	Publishers
1	Pandya and Camy	Environmental Engineering	Tata McGraw Hill
2	Asthana D.K. and Asthana Meera	Environmental Problems and Solutions	S. Chand & Co.
3	Gilbert M. Masters	Introduction to Environmental Engineering and Science.	Prentice Hall of India (PHI)
4.	M N Rao & HVN Rao	Air Pollution	Tata McGraw Hill

FIELD ACTIVITIES (OPTIONAL)

1. Visit to Selaulim/ Anjunem Dam.
2. Visit to show Hill cuttings, mining areas.
3. Visit to show Rain water harvesting project / Vermicomposting plant / watershed management project. (Krishi Vigyan Kendra – Old Goa)
4. Visit to Garbage treatment plant.

***On Completion of visit Report to be submitted.**

(GC204) ENGINEERING DRAWING

1. Course Objective: Drawing is a graphical language of engineering field. Engineering technician irrespective of his/her field of operation in an industry is expected to possess a thorough understanding of drawing, which includes 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. Besides this he/she is also expected to possess a certain degree of drafting skills- depending upon his/her job.

2. **TEACHING AND EXAMINATION SCHEME:**

Course Code & Course Title	**Periods/ Week (In Hours)**			**Total Hours**	**Examination Scheme**				
					Theory Marks		**Practical Marks**		**Total Marks**
(GC204)	**L**	**T**	**P**	**H**	**TH**	**TM**	**TW**	**PR/OR**	
Engineering Drawing	-	-	5	80	-	-	50	50	**100**

3. Course Outcomes:

On successful completion of the course the student will be able to:
GC204.CO1: Understand different methods of projection, sectioning of solids and development of surfaces.
GC204.CO2: Select the relevant procedural methods for preparing Engineering Drawing.
GC204.CO3: Draw Isometric views and orthographic projection of full and sectioned objects and development of surfaces
GC204.CO4: Examine and Interpret Engineering Drawings

4. Mapping Course Outcomes with Program Outcomes

Relationship- 1:Slight (low) 2:Moderate(Medium) 3: Substantial(High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
	Basic and discipline specific knowledge	Problem analysis	Design & development of solution	Engg tools exptn and & testing	Engg Practice for society,sustainability and environment	Project management	Lifelong learning
CO1	3	2	1	3	1	1	1
CO2	3	1	2	3	1	2	2
CO3	2	2	2	3	1	2	2
CO4	2	2	2	2	1	2	3

5. Detailed course Contents/ Micro lesson plan

M=Marks Prhr= Teaching Hrs CO=Course Outcomes

Unit	Mark	Prhr	CO
1. Introduction 1.1 Importance of engineering drawing as a means of communication. 1.2 Planning of drawing sheet as per SP 46(latest revision) 1.3 Indian standard practices of laying out and folding of drawing 1.4 Different types of lines used in engineering drawing. 1.5 Importance of scale in Engineering Drawings. 1.6 Lettering 1.7 Methods of dimensioning, Dimensioning terms and notation -use of SP 46(latest revision), General rules for dimensioning, Dimensioning of cylinder, holes, arcs of circle, narrow space, angles, countersunk hole, taper.	05	05	CO2
2. Geometrical construction & Engineering Curves 2.1Construction of an Equilateral and Isosceles triangle, Square, Regular pentagon & Regular hexagon given length of a side using general method of construction 2.2Construction of Engineering curves like: Ellipse- by focus & directrix method and arcs of circles method Parabola- by focus & directrix method and rectangle method Hyperbola- Focus and directrix method 2.3 Cycloid- by generating circle rolling on a straight line 2.4 Involutes of a circle. 2.5 Draw normal & tangents to the above curves from given point on the curve Curves to be explained with the help of applications.	05	15	CO2
3. Orthographic projection 3.1 Definitions of various terms associated with orthographic projections. Planes of projections. Concept of Quadrants. 3.2 First and third angle method of projection. 3.3 Projection of points 3.4Projection of lines	18	30	CO1, CO2, CO3, CO4

Parallel to both Principal planes Parallel to one and Perpendicular to other Principal plane. Inclined to one plane and parallel to other plane. 3.5 Projection of planes:Triangle, Square, circle when inclined to one principal plane & perpendicular to other plane. 3.6 Projection of solids: Cylinder, cone. Right regular solids such as (i) Prism: Square& Pentagonal (ii) Pyramid: Triangular & Square. Projections of above mentioned solids when axis is inclined to one principal plane & Parallel to other principal plane. 3.7 Conversion of simple pictorial views into orthographic views. *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 shape of plane are given, true shape & slope angle are to be drawn are excluded.*			
4. Section of solids Development of lateral surfaces **4.1** Concept of sectioning planes, Auxiliary planes and true shape of section. 4.2 Drawing section of solids like square prism, square 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) 4.3Concept and importance of surface development in the engineering field. Methods of development of surfaces-Radial & Parallel line method. Development of surfaces for solids like square prism, square pyramid, cylinder and cone. *Development of solids standing on its base & cut by a plane inclined to HP and perpendicular to VP is also included.*	10	15	CO1, CO3
5. Isometric Views 5.1Difference between Isometric projection & Isometric view. 5.2Isometric view of geometrical planes and solids.	12	15	CO3, CO4

5.3Conversion of orthographic views into isometric views. 5.4Construction of Isometric view for any real object.			
Total	50	80	

6. Course Delivery:

The course will be delivered through Practicals, class room interaction and exercises.

7. Specification table for Practical/Macro Lesson Plan

Unit No.	**Unit**	**No. Of Practical Hrs.**	**Marks**
1	Introduction	05	05
2	Geometrical construction & Engineering Curves	15	05
3	Orthographic projection	30	18
4	Section of solids Development of lateral surfaces	15	10
5	Isometric Views	15	12
	Total	**80**	**50**

8. Specification table for Practical/ Termwork:

No.	Practical
1	TYPES OF LINES, LETTERING, DIMENSIONING.
2	GEOMETRICAL CONSTRUCTIONS
3	ENGINEERING CURVES
4	PROJECTION OF POINTS & LINES
5	PROJECTION OF PLANES
6	PROJECTIONS OF SOLIDS
7	ORTHOGRAPHIC PROJECTIONS (First angle)
8	ORTHOGRAPHIC PROJECTIONS(Third angle)
9	SECTIONS AND DEVELOPMENT OF SOLIDS
10	ISOMETRIC VIEWS

9. Learning Resources:

Text Books

S.No.	Author	Title	Publisher
1	N.D. Bhatt	Engineering Drawing	Charoter Publisher,Anand
2.	R. K. Dhawan	Engineering Drawing	S. Chand Publishing
3.	K.R. Gopalakrishna	Engineering Drawing	Subhas Publications.

Reference Books only for further study

S.No.	Author	Title	Publisher
1	P.S. Gill	Geometrical Drawing	Kataria & Sons
2	P.S. Gill	Machine Drawing	Kataria & Sons
3	N.D. Bhatt	Machine Drawing	Charoter Publisher,Anand

Indian and International codes needed

S.No.	Author	Title	Publisher
1.	BIS, India	SP 46. (Latest revision).	BIS, India

(GC205) ENGINEERING MATERIALS

1. COURSE OBJECTIVE:

This course is introduced with an objective of providing knowledge to students regarding properties and composition of materials for engineering applications and enabling them to make comparative study of materials while selecting the appropriate material for various engineering applications.

2. TEACHING AND EXAMINATION SCHEME

Semester	**II**								
Course code & course title		**Periods/Week (in hours)**			**Total Hours**	**Examination Scheme**			
						Theory Marks		**Practical Marks**		**Total Marks**
(GC205) ENGINEERING MATERIALS		**L**	**T**	**P**	**H**	**TH**	**TM**	**TW**	**PR/OR**	
		3	**--**	**--**	**48**	**75**	**25**	**--**	**--**	**100**

3.COURSE OUTCOMES:

On successful completion of the course, the student will be able to:

GC205.CO1: List out the properties of materials used in engineering applications.

GC205.CO2: Explain the composition and properties of various engineering materials.

GC205.CO3: Classify materials based on composition and properties.

GC205.CO4: Select the appropriate material/s for the given engineering application/s.

4. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific Knowledge	Problem Analysis	Design and Devlopment of Solutions	Engg. Tools, Experimentatn & Testing	Engg. Practices for Society,Sustain ability & Environment	Project Management	Life -long Learning
CO1	3	2	0	0	0	0	1
CO2	3	2	1	0	0	0	1
CO3	2	2	2	1	1	0	1
CO4	2	3	3	2	1	0	1

Relationship : Low-1 Medium-2 High-3

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	**Thr = Teaching hours**	**CO = Course Objectives**			
Unit			**M**	**Thr**	**CO**
1 INTRODUCTION TO ENGINEERING MATERIALS			**08**	**04**	
1.1 Classification of Materials: Metal and Non-metal, Ferrous Metal & Non-ferrous Metals, Differences between Metals & Non-metals					**CO1, CO2, CO3, CO4**
1.2 Properties of Materials:(Note: Properties to be explained with relevant examples.) 1.2.1 Physical properties – Melting point, Freezing point, Boiling point, Density, Linear co-efficient of expansion, Thermal conductivity, Electrical resistivity					
1.2.2 Mechanical properties – Strength, Elasticity, Plasticity, Ductility, Malleability, Toughness, Brittleness, Hardness, Fatigue, Creep.					
1.2.3 Electrical properties – Resistivity, Conductivity, Temperature coefficient of resistance, Dielectric strength, Thermo-electricity, Super conductivity					
1.2.4 Magnetic properties – Permeability and Coercive force					
1.2.5 Chemical properties - Corrosion resistance and Chemical composition					
2 FERROUS & NON-FERROUS METALS & ITS ALLOYS			**18**	**12**	
2.1 FERROUS ALLOYS: 1.1.1 Low carbon steel, Medium carbon steel, High carbon steel, their carbon percentage, properties & uses. 1.1.2 Cast iron: grey cast iron, white cast iron, their properties & uses 1.1.3 Alloy steels: Constituents of alloy steels such as Phosphorous, Sulphur, Silicon, Manganese and their effect on properties of materials. 1.1.4 Stainless steel, Nickel-chromium-molybdenum steel, its properties & uses. 1.1.5 Tool steel – composition, HSS, properties & uses					**CO1, CO2, CO3, CO4**
2.2 NON-FERROUS METALS & ALLOYS: 2.2.1 Aluminium – Properties & uses 2.2.2 Aluminium alloys – constituents of alloy & their effect on properties of metal 2.2.3 Properties & uses of Duralumin, Y-alloy and Al-Si alloy 2.2.4 Copper – Properties & uses. 2.2.5 Copper alloys – Constituents of alloy & their effect on properties of metal 2.2.6 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. 2.2.7 Lead and its hazard to the environment					**CO1, CO2, CO3, CO4**
3 NON-METALLIC MATERIALS			**18**	**10**	
3.1 CONSTRUCTION MATERIALS 3.1.1 Classification of rocks, common building stones and their applications. 3.1.2 Cement: Types of cement, composition and applications 3.1.3 Bricks: Composition, properties, Classification, Special bricks- Refractory and fly-ash bricks and uses 3.1.4 Clay: Types, products of clay- tiles and pipes 3.1.5 Sand- sources – river, crushed aggregates, applications					**CO1, CO2, CO3, CO4**
3.2 ENGINEERING CERAMICS					

3.2.1 Refractories: Desirable properties, Properties and Applications of Fire clay and Silica Refractory, Difference between acid, basic & neutral refractories 3.2.2 Glass: Properties & uses of soda glass, borosilicate glass and fibre glass 3.2.3 Glass wool: Composition, properties & uses 3.2.4 Timber: Common varieties of timber, uses of wood products, veneer and plywood 3.2.5 Natural & Synthetic abrasive materials: Introduction, Properties & uses			**CO1, CO2, CO3, CO4**
4 CONDUCTOR, SEMI -CONDUCTOR, AND INSULATING MATERIALS	**16**	**12**	**CO1, CO2, CO3, CO4**
4.1 Classification of Materials as Conductor, Semiconductor and Insulating materials			
4.2 Conductor Material: 4.2.1 High conductivity materials: Copper, Aluminium, Carbon, Silver, Lead & Tungsten, their properties as conducting materials and applications. 4.2.2 High resistivity materials: nichrome, constantan, manganin and their applications			
4.3 Insulating Materials: Introduction and Characteristics of Good Insulating materials 4.3.1 Solid Insulating materials- wood, paper, rubber, mica, glass fibre, porcelain, PVC, resins, their characteristics as insulating materials and applications			
4.4 Semiconductor Materials: Silicon & Germanium, their specifications as semiconductor material and uses.			
Unit 5 MAGNETIC & COMPOSITE MATERIALS	**15**	**10**	
5.1 Magnetic Materials: Classification as Diamagnetic, Paramagnetic, Ferromagnetic, List of these materials and their applications			**CO1, CO2, CO3, CO4**
5.2 Composite Materials**:** metal matrix, ceramic matrix and polymer matrix composites, types of reinforcement materials and their applications			
5.3 Paints & Lubricants: 5.3.1 Classification: oil based and polymer based paints 5.3.2 Constituents of Paints – resin, binder, pigment, additives, solvents 5.3.3 Lubricants – Functions of lubricants, Types of Lubricants**,** Composition and Applications			
Total	**75**	**48**	

6. COURSE DELIVERY:

The Course will be delivered through lectures and class room interactions

7. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	**Unit Name**	**Number of lectures (hrs)**	**Marks**
1	Introduction to Engineering Materials	04	08
2	Ferrous & Non-Ferrous Metals & its alloys	12	18
3	Non-Metallic Materials	10	18
4	Conductor, Semi-Conductor, & Insulating Materials	12	16
5	Magnetic & Composite Materials	10	15
		48	**75**

8. LEARNING RESOURCES

Text Books

S. No.	Author	Title of Books	Publishers
1	R.S. Khurmi	Material Science	S. Chand
2	R. Srinivasan	Engineering Materials & Metallurgy	Tata McGraw Hill
3	TTTI Madras	Electrical Engineering Materials	McGraw Hill Education, 2004
4	S. K. Hajra Choudhury	Material Science and Processes	Indian book distribution
5	P. C. Varghese	Building Materials	PHI
6	J. B. Gupta	Electrical and Electronic Engineering Materials	Katson

(CC301) ENGINEERING MECHANICS

1. COURSE OBJECTIVES:

The students will be able to acquire knowledge of Engineering Mechanics is imperative in the analysis of static or dynamic force systems. The related concepts find extensive applications in the analysis of machine elements, fluids, structures, and every engineering problem that involves force or motion. The subject is a basis of myriads of higher-level subjects like Hydraulics, Strength of Materials, Theory of Machines and Machine Design, and practically there is no branch of engineering where the subject renders no scope.

2. TEACHING AND EXAMINATION SCHEME

Semester	III								
Course code & course title		Periods/Week (in hours)			Total Hours	Examination Scheme			
						Theory Marks		Practical Marks	Total Marks
Engineering Mechanics		L	T	P	H	TH	TM	TW	PR/OR	
		3	1	1	5	75	25	25	-	125

3. COURSE OUTCOMES:

On successful completion of the course, the student will be able to:

CC301CO1: Define various force systems, Equilibrium, centre of gravity, friction & dynamics.

CC301CO2: Explain methods to determine unknown reactions, forces, velocities and accelerations, Centroid, centre of gravity, friction machine efficiency, momentum & impulse.

CC301CO3: Solve problems on equilibrium of rigid bodies, centre of gravity, simple machines, friction, kinetics, momentum & impulse.

CC301CO4: Verify various laws & machine equations.

4. Mapping Course Outcomes with Program Outcomes

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PS01	PSO2
CO1	3	1	0	0	0	0	0	1	0
CO2	3	2	1	1	0	1	0	2	1
CO3	3	3	2	1	0	1	2	3	1
CO4	3	3	1	2	1	2	2	2	2

Relationship : Low-1 Medium-2 High-3

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	Thr = Teaching hours			
Unit		M	Thr	CO
1 Forces and Moments.				
1.1 FUNDAMENTALS Definition and unit of force, types of force, characteristics of force, effects of force, principle of transmissibility of force, resultant, equilibrant.		3	1	
1.2 FORCE SYSTEM		3	2	

System of forces, resolution and composition of forces (Resolution along x and y axis), resolution of force along a plane and perpendicular to it (only introduction, no problems to be framed.)			**CO1 CO2 CO3 CO4**
1.3 RESULTANT Application of the principle of resolution to—1) find the resultant of a coplanar, concurrent force system, and 2) determine the missing force when the resultant is given.	6	3	
1.4 MOMENT Moment—Definition, unit, sign convention (clockwise moment +, anticlockwise -), couple and its characteristics. Avignon's theorem-- statement and application to compute the resultant in magnitude, direction and position in case of coplanar non-concurrent, and coplanar parallel force system.	6	4	
2 Equilibrium.			
2.1 FUNDAMENTALS Concept of equilibrium of forces, conditions of equilibrium of two forces, three forces, concurrent and non-concurrent force systems, concept and drawing of free body diagram for not more than three bodies.	3	2	
2.2 LAMI'S THEOREM Lami's theorem- statement and application to problems based on strings with suspended weights, and spheres.	6	3	**CO1 CO2 CO3 CO4**
2.3 BEAMS Types of beams, types of support, types of loadings. Application of equilibrium conditions to the beams (Beams with simple or roller support at the two ends) with concentrated loading, UDL, partially applied UDL only.	6	5	
3 Centroid and Centre of gravity.			
Definition of centroid, centroid of rectangle, triangle, circle, semicircle, trapezium. Centroid of simple composite figures (including cut out sections.) Definition of centre of gravity. Centre of gravity of solids-- cone, sphere, cylinder, hemisphere, rectangular solid. Centre of gravity of simple composite solids (including cut out solid portions)	9	7	**CO1 CO2 CO3**
4 Friction and Simple machines			
4.1Friction—FUNDAMENTALS Concept of friction, Coulomb's law of static friction, coefficient of friction, angle of friction, cone of friction, angle of repose.	3	1	
4.2 APPLICATIONS Application of concept of friction to a block resting on horizontal or inclined plane, ladder friction.	6	5	**CO1 CO2 CO3**
4.3 FUNDAMENTALS OF SIMPLE MACHINES Definition of simple machine, load, effort, mechanical advantage, velocity ratio, efficiency of machine, law of machine, reversibility of machine, self-locking machine. (Simple problems to be framed, no derivations.)	3	2	**CO4**

4.4 STUDY OF SIMPLE MACHINES Simple axle and wheel, single purchase crab, double purchase crab, screw jack. (Simple problems to be framed, no derivation.)	6	4	
5 Dynamics			
5.1 KINETICS D' Alembert's principle and its applications to solve simple problems related to motion of lift, two bodies connected by a single string passing over a pulley, two string connected bodies of which one is lying on a horizontal plane (or on inclined plane) while the other suspended freely.	9	5	**CO1** **CO2** **CO3** **CO4**
5.2 MOMENTUM, IMPULSE AND IMPULSIVE FORCE Momentum, impulse and impulsive force—definition and unit. Law of conservation of momentum, simple problems based on momentum, impulse, impulsive force, and law of conservation of momentum.	6	4	
Total	**75**	**48**	

6. COURSE DELIVERY:

The course will be delivered through lectures, class room interactions, exercises and case studies.

7. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	Force and moment	10	18
2	Equilibrium	10	15
3	Centroid and centre of gravity	7	9
4	Friction and simple machines	12	18
5	Dynamics	9	15
	Total	48	75

8. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS.

Sr. No.	Practical (Minimum six to be conducted)	Marks
1.	Verification of Polygon law of forces.	
2.	Verification of Lami's theorem.	
3.	Determination of coefficient of friction (between any two different surfaces.)	
4.	Calculation of support reactions using Beam apparatus.	
5.	Determination of MA, VR, efficiency and law of machine for any three simple lifting machines.	
6.	Determination of angle of repose.	
7.	Determination of the resultant of coplanar and concurrent forces (Graphical analysis, one sheet.)	
8.	Determination of the resultant of coplanar, non-concurrent forces, and parallel forces. (Graphical analysis, one sheet.)	
No	**Class room Assignments**	
1	At least three assignments covering above units.	

No	**Tutorial Exercise**	
1	At least six problems on each of the units mentioned above.	
	Total	25

9. LEARNING RESOURCES

9.1 Text Books

S. No.	Author	Title of Books	Publishers
1	Dhade, Jamdar and Walawalkar.	Fundamentals of Applied Mechanics	Sarita Prakashan, Pune.
2	R.S.Khurmi	Applied Mechanics	S. Chand
3	A. R. Basu	Engineering Mechanics	Tata MacGraw Hill, Delhi.
4	Patel, Sanghavi and Thakur	Engineering Mechanics	Mahajan Publishing House, Ahmedabad.

9.2 Reference Books for further study

S. No.	Author	Title of Books	Publishers
1	Beer-Johnson	Engineering Mechanics	Tata McGraw Hill, Delhi.
2	Joseph F. Shegley	Vector Mechanics for Engineers Vol-1 and 2	Tata McGraw Hill, Delhi.

9.3Internet and Web Resources

S. No.	Author	Title of Books	Publishers
1	WizIQ	https://www.wiziq.com/tutorials/applied-mechanics	-
2	NPTEL	https://nptel.ac.in/courses/122102004	-

9.4 Videos and Multimedia Tutorials

S. No.	Author	Title of Books	Publishers
1	NITTTR	CDs of experiments in Engineering Mechanics.	-
2	NPTEL	CDs of experiments in Engineering Mechanics.	-

ELEMENTS OF MECHANICAL ENGINEERING (CC307)

1. COURSE OBJECTIVES / 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 Fabrication Technology & Erection Engineering.

Students will be able to

1. Understand use of different mechanical power transmission devices.
2. Explain functions of various components of IC engines, boilers, pumps air conditioning systems etc.
3. Demonstrate use of different maintenance tools.

2. PRE-REQUISITES: Nil

3. TEACHING AND EXAMINATION SCHEME

Semester	**III**								
Course code & course title		**Periods/Week (in hours)**			**Total Hours**	**Examination Scheme**			
						Theory Marks		**Practical Marks**		**Total Marks**
(CC307) Elements of Mechanical Engineering		**L**	**T**	**P**	**H**	**TH**	**TM**	**TW**	**PR**	
		3	0	0	3	75	25	25	-	125

4. COURSE OUTCOMES:

On successful completion of the course, the student will be able to:

CC307.CO1. Explain power transmission devices, parts of I.C. engines, boilers, pumps and refrigeration equipments

CC307.CO2. Identify various parts and uses of I.C. engines, boilers accessories and refrigeration components

CC307.CO3. Distinguish between various types of I.C. engines, boilers and pumps

CC307.CO4. Discuss the application of various types of lubricants, maintenance tools, couplings and bearing

5. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CO 1	2	1	-	3	-	3	-
CO 2	2	-	1	1	-	-	-
CO 3	2	2	2	-	-	2	-
CO 4	3	3	3	2	3	3	3

Relationship : Low-1 Medium-2 High-3

	PSO1	PSO2
CO1	-	2
CO2	-	2
CO3	-	2
CO4	-	2

6. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	**Thr = Teaching hours**	**CO = Course Objectives**			
Unit			**M**	**Thr**	**CO**
1 MECHANICAL POWER TRANSMISSION			**15**	**8**	CO1, CO4
1.1 Belt drives – classification & applications Chain drives – Power transmitting chains (Block chain, Bush roller chain) and their applications. Gear drives –Spur, Helical & Bevel gear drives and their applications Gear trains (simple & compound only) and their speed ratio.			9	5	CO1
1.2 Couplings – rigid coupling (marine type only), flexible coupling (bush pin type only) Bearings – Definition & function of bearings, rolling and sliding contact bearings (their functions and applications.)			6	3	CO1, CO4
2 I.C. ENGINES			**18**	**12**	CO2, CO3
2.1 Introduction, classification & basic engine components.			6	3	CO2
1.2 Construction and working of 4 stroke and 2 stroke engines (petrol & diesel). Difference between petrol and diesel engines. Difference between 2 stroke and 4 stroke engines. Technical terms of I.C. engines – Stroke volume, Compression ratio, Brake power.			12	9	CO2, CO3
3 THERMAL ENGINEERING EQUIPMENTS & PUMPS			**21**	**14**	**CO1, CO2, CO3**
3.1 Introduction. Basic components of a thermal power station and their function (Condenser, Turbine, Boiler).			6	4	CO1
3.2 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-, water level indicator, and super heater. Awareness to Indian Boiler Regulations i.e. IBR (Brief Introduction)			9	6	CO2, CO3
3.3 Introduction, working principle, classification. Centrifugal and reciprocating pump -construction & working. Comparison between Centrifugal pump & Reciprocating pump. Technical specifications - power, discharge, head.			6	4	CO1, CO3
4. REFRIGERATION & AIR CONDITIONING			**12**	**7**	**CO1, CO2**
4.1 Introduction, unit of refrigeration (Ton), COP, Working and operation of simple vapour compression system (p-h & t-s diagrams to be excluded).			6	4	CO1, CO2
4.2 Air Conditioning- definition, working of Window and split Air conditioner			6	3	CO2
5. MAINTENANCE ENGINEERING			9	7	CO1, CO4
5.1 Definition, types -preventive, breakdown and predictive maintenance. Necessity of lubrication. Common types of lubricants. Methods of lubrication – wick/drip type, grease gun, grease cup.			6	4	CO1, CO4

5.2Maintenance tools and their functions (no construction & working) – spanners (open end & ring type), screw jack, gauges, screw driver, torque wrench, allen key, chain pulley block.	3	3	CO4
Total	**75**	**48**	

7. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies

8. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	**MECHANICAL POWER TRANSMISSION**	08	15
2	**I.C. ENGINES**	12	18
3	**THERMAL ENGINEERING EQUIPMENTS & PUMPS**	14	21
4	**REFRIGERATION & AIR CONDITIONING**	07	12
5	**MAINTENANCE ENGINEERING**	07	09
6	**MECHANICAL POWER TRANSMISSION**	08	15
	Total	48	75

9. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	Practical	Marks
1.	Study of different types of gears.	
2.	Removal and mounting of belt. Checking tension in the belt.	
3.	Demonstration of mounting and removal of ball/roller bearing., Knowing its bearing number	
4.	Study of petrol/diesel engine construction.	
5.	Study of petrol/diesel engine working.	
6.	Study of water tube and fire tube boiler (Babcock & Wilcox and Cochran).	
7.	Study of any one refrigeration Air conditioning equipment , method of installation for AC	
8.	Study of centrifugal and reciprocating pumps and common faults in pumps with their troubleshooting	
9.	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.	
	Total	25
No	**Class room Assignments**	**Marks**
1	At least 10 covering all units above	
No	**Tutorial Exercise**	**Marks**
1	At least 10 problems on each unit given above	
2		
...	Total	25

10. LEARNING RESOURCES

Text Books

S. No.	Author	Title of Books	Publishers
1	R.S. Khurmi	Theory of Machines	
2	R.S. Khurmi	Thermal Engineering	S. Chand
3	R.K. Rajput	Textbook of Hydraulic Machines	Laxmi
4	R.K. Rajput	Refrigeration & Air Conditioning	Laxmi
5	S.N. Bhattacharya	Installation, Servicing & Maintenance	S. Chand

BASIC WELDING TECHNOLOGY (FB301)

1. COURSE OBJECTIVES / RATIONALE:

The Welding Technology has given a fillip to the fabrication industry. Hence, the study of Welding Technology is very much essential. Basic Welding Technology covers the advantages of welding as a fabrication process and various terminologies. The Arc and Gas welding processes, equipment, techniques and safety aspects are covered. Welding of ferrous, non- ferrous and dissimilar metals in various positions is briefed. Braze welding; Brazing and Soldering have also been included.

2. PRE-REQUISITES:

Students should know
1. Engineering Materials
2. Basic Engineering Practice

3. TEACHING AND EXAMINATION SCHEME

Semester	**III**								
Course code & course title		**Periods/Week (in hours)**			**Total Hours**	**Examination Scheme**			
						Theory Marks		**Practical Marks**		**Total Marks**
(FB301) Basic Welding Technology		**L**	**T**	**P**	**H**	**TH**	**TM**	**TW**	**PR**	
		3	0	4	7	75	25	25	25	150

4. COURSE OUTCOMES:

On successful completion of the course, the student will be able to:

FB301.CO1. Describe and Explain various metal joining processes
FB301.CO2. Select and Apply appropriate type of metal joining process to suit a specific application
FB301.CO3. Analyse various aspects of metal joining process and make necessary adjustments to the process to minimise adverse effects of various factors
FB301.CO4. Produce various types of joints in different positions in safe working conditions

5. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CO 1	3	1	1	1	1	1	1
CO 2	3	3	3	3	1	1	1
CO 3	3	3	3	3	1	1	1
CO 4	3	1	1	3	1	1	1

Relationship : Low-1 Medium-2 High-3

	PSO1	PSO2
CO1	1	1
CO2	3	3
CO3	3	3
CO4	3	3

6. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	Thr = Teaching hours	CO = Course Objectives

Unit	M	Thr	CO
1 WELDING- A FABRICATION PROCESS			
1.1 Introduction – Approach towards new fabrication and repairs. Classification of welding processes. Commonly welded base metals	3	1	CO1, CO2
1.2 Welding as compared to Riveting & Casting. Advantages, Disadvantages, Applications of welding	3	2	CO1, CO2
2 WELDING TERMINOLOGY			
2.1 Terms used in welding – Base metal, Filler metal, Weld metal, Molten pool, Fusion Zone, Heat Affected Zone, Reinforcement, Penetration, Weld face, Weld root, Weld toes, Root gap, Root face, Weaving, Run or Pass, Flux, Slag & Distortion. Weld Bead Geometry. Types of welded joints: Butt, Lap, Tee, Edge, Corner. Welding positions: Flat, Horizontal, Vertical, Inclined, Overhead.	4	2	CO1, CO2, CO4
2.2 Types of edge preparation and its need. Welder Qualification based on welding position. Back gouging, filling and its need.	4	2	CO1, CO2
3 MANUAL METAL ARC WELDING			
3.1 Definition of Arc Welding. Physics of Welding: Welding Arc, Arc Initiation methods.	6	2	CO1
3.2 Arc-blow: Factors affecting arc blow, Types of arc blow, Mechanism of arc blow, Effects of arc blow, Remedies for arc blow.	6	2	CO1, CO3
3.3 Metal Transfer: Free flight transfer, Short circuiting type.	6	2	CO1
3.4 Arc Welding equipments: a) Power Sources (brief description) - Transformers, Rectifiers, Generators, Inverter. b) Welding electrodes – Brief classification of welding electrodes, Types of covered electrodes, Electrodes coatings ingredients & their functions, Manufacture of flux coated electrodes, Selection of electrodes, Care & storage of electrodes, Classification and coding of electrodes: AWS-ASTM, BS, IS. c) Other accessories equipments: Welding cables, Electrode holder.	9	5	CO1, CO2, CO3
3.5 Welding of round bars and pipes. Welding of ferrous, non-ferrous and dissimilar metals. Protection of welders. Safety recommendations for arc welding.	6	3	CO1, CO2, CO4
4 OXY- ACETYLENE WELDING			
4.1 Definition of Gas Welding. Equipments: Oxygen Cylinder, Acetylene cylinder, Acetylene gas generator, Anti flash back device, Manifold system for gas welding, Oxygen & Acetylene Pressure regulator: Single stage, Two stage, Difference between Oxygen & Acetylene Pressure regulator, Hose pipe, Welding torch or blow pipe: Low pressure torch, High pressure torch, Welding nozzles tips.	9	6	CO1, CO2
4.2 Principle of operation. Types of Oxy-Acetylene flames. Gas Welding techniques: Leftward Technique & Rightward Technique, Comparison of both.	6	4	CO1, CO2, CO3
4.3 Advantages, Disadvantages, Applications of Gas welding. Air-Acetylene Welding. Safety recommendation for gas welding.	4	1	CO1, CO2, CO4
5 BRAZE WELDING, BRAZING & SOLDERING			

5.1 Braze welding: Definition, Principle of operation, Advantages, Limitations & Applications.	3	1	CO1, CO2, CO3, CO4
5.2 Brazing: Definition, Principle of operation, Advantages, Limitations & Applications.	3	1	CO1, CO2, CO3, CO4
5.3 Soldering: Definition, Principle of operation, Advantages, Limitations & Applications. Comparison of Welding, Braze welding, Brazing & Soldering.	3	2	CO1, CO2, CO3, CO4
Total	**75**	**36**	-

7. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies

8. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	WELDING- A FABRICATION PROCESS	3	6
2	WELDING TERMINOLOGY	4	8
3	MANUAL METAL ARC WELDING	14	33
4	OXY- ACETYLENE WELDING	11	19
5	BRAZE WELDING, BRAZING & SOLDERING	4	9
	Total	36	75

9. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	Practical	Marks
1.	Practical Title	
1	Study of Arc welding equipments	5
2	Study of various protective clothing	5
3	Performing MMAW in Flat position i. Practice for striking arc and obtaining weld bead on plate ii. Weld pad building iii. Square butt, V-butt joint, Lap joint, Tee joint, Edge joint and Corner joint iv. Pipe to pipe & pipe to plate	10
4	Performing MMAW in Vertical position i. Practice for striking arc and obtaining weld bead on plate ii. Weld pad building iii. Square butt, V-butt joint, Lap joint, Tee joint, Edge joint and Corner joint iv. Pipe to pipe & pipe to plate	10
5	Study of Oxy-Acetylene gas welding equipments	5
6	Performing Oxy-Acetylene welding in Flat position i. Practice to operate the equipments ii. Fusion runs & Running bead iii. Butt joint with filler & without filler	10
7	Demonstration of braze welding, brazing and soldering	5

	Total	50
No	**Class room Assignments**	**Marks**
1	At least 10 covering all units above	
2		
...		
No	**Tutorial Exercise**	**Marks**
1	At least 10 problems on each unit given above	
2		
...	Total	

10. LEARNING RESOURCES

Text Books

S. No.	Author	Title of Books	Publishers
1	Dr. O. P. Khanna	A text- Book of Welding Technology	Dhanpat Rai & Sons , Delhi
2	A.C. Davies	The Science and Practice of Welding	Cambridge University Press
3	Dove Smith Gregg Division	Welding Skills and Technology	Mc Graw Hill Book Company
4	A.D. Althouse, C.H. Turnquist and W.A. Bowditch	Modern Welding	The Goodheart- Willeox Co.
5	Richard, L. Little	Welding and Welding technology	Tata McGraw hill Publishing Company Ltd.
6	Richard, L. Little	Welding and Welding technology	Tata McGraw hill Publishing Company Ltd.

Reference Books for further study

S. No.	Author	Title of Books	Publishers
1	-----	Metals Handbook, volume 6- Welding and Brazing	American Society for Metals (ASM)
2	-----	AWS Code book (Concise edition)	-----
3	-----	Welding Journals (Indian Institute of Welding and American Welding Society)	-----
4	-----	Welding Handbook Vol. I-V	American Welding Society 550, N.W. Le Jeune Road P.O. Box 351040

FABRICATION DRAWING (FB302)

1. COURSE OBJECTIVES / RATIONALE:

This course in drawing is designed to suit the need of fabrication engineering technicians who are required to have adequate knowledge of preparing and reading fabrication drawing to execute projects and includes the design drawing, fabrication drawing, structural drawing (Steel Structures) & piping drawing.

2. PRE-REQUISITES:

Students should know
1. Engineering Drawing

3. TEACHING AND EXAMINATION SCHEME

Semester	**III**								
Course code & course title		**Periods/Week (in hours)**			**Total Hourss**	**Examination Scheme**			
						Theory Marks		**Practical Marks**	**Total Marks**
(FB302) Fabrication Drawing		**L**	**T**	**P**	**H**	**TH**	**TM**	**TW**	**PR**	
		2	0	4	6	75	25	25	-	**125**

4. COURSE OUTCOMES:

On successful completion of the course, the student will be able to:

FB302.CO1. Recognise various types of rolled steel sections, riveted joints, pipe joints, pipe bends, pipe supports & structural drawings

FB302.CO2. Interpret symbols, pictorial views, orthographic views, isometric views & developed view from fabrication drawing

FB302.CO3. Sketch various types of rolled steel sections, riveted joints, pipe joints, pipe bends, pipe supports & structural drawings

FB302.CO4. Determine sectional and design parameters to prepare fabrication drawing and subsequently bill of materials

5. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CO 1	3	1	1	1	1	1	1
CO 2	3	3	1	1	1	1	1
CO 3	3	1	1	1	1	1	1
CO 4	3	3	3	1	1	1	1

Relationship : Low-1 Medium-2 High-3

	PSO1	PSO2
CO1	3	1
CO2	3	2
CO3	3	2
CO4	3	3

6. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	Thr = Teaching hours	CO = Course Objectives	

Unit	M	Thr	CO
1 INTRODUCTION			
1.1 Terms: Fabrication technology, Fabrication drawing, Design drawing, Machine drawing, Foundation or anchor bolt, Bearing plate, Column, Beam, Girder, Cleats, Splicing, Bracing, Lacing, Shop clearance, Site clearance, Gauge line, Bench mark, Erection diagram, Edge clearance, Driving clearance.	3	1	CO1
1.2 Designation and specification of rolled section (I-beams, channels, equal angle, 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.	4	4	CO1, CO3
1.3 Determination of sectional and design parameter of a particular section. For I-beam, connection details	3	1	CO1, CO4
2 SYMBOLS FOR JOINTS			
2.1 Conventional symbol for rivets, bolts and riveted joints. Symbols for site and shop rivets 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.	3	2	CO1, CO4
2.2 Different types of riveted joints. Determination and selection of rivet size. Sketch of riveted joints of known thickness of plates and dimensioning clearly.	6	5	CO1, CO2, CO3, CO4
2.3 Weld symbols, Position of symbols on drawing, Dimensioning of welds, Complementary indications, Practical examples.	4	2	CO2
3. FABRICATION DRAWING			
3.1 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.	12	3	CO1, CO2, CO4
3.2 Drawing the orthographic views, isometric view and detailed drawing of each member from assembly pictorial sketch of any simple support made up of rolled sections of welded joints only.	8	2	CO1, CO2, CO4
3.3 Preparing Bill of Materials	4	1	CO2, CO4
4 STRUCTURAL DRAWING (sketches only)			
4.1 Different column base connections (welded and riveted). Detailing of beams and columns. Column to beam connections & Beam to beam connections.	3	3	CO3
4.2 Lacing systems. Different column splices. Different parts & types of roof trusses. Typical ridge joint & Typical shoe joint.	3	1	CO3
4.3 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.	3	3	CO3
5 PIPING AND PIPELINE DRAWINGS			
5.1 Introduction: Purpose of pipelines, Specification of M.S. pipes, Pipe manufacture.	3	1	CO1

5.2 Pipe joints (sketches only): Screwed pipe joints, Gland pipe joints: welded flange, screwed flange, forged flange. Welded pipe joint: Plain butt-welded, Butt-welded with backing ring. Bell and Spigot pipe joint.	3	1	CO3
5.3 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.	3	1	CO3
5.4 Pipe supports: Need of pipe support, Types (sketches only): Clamp type hanger, Turn buckle hanger, U-bolt hanger, Plate hanger, Roller support, Screw jack support. Pipe fittings: Elbow, Tee, Union, Reducers, Laterals, Globe valve, Gate valve, Stopcock, Plug or cap, coupling.	4	2	CO3
5.5 Pipeline Drawing: Single Line, Double Line, Isometric view, Orthographic view, Developed view, Drawing Orthographic views from Isometric view. Drawing isometric view from Orthographic views.	6	3	CO2, CO4
Total	**75**	**36**	-

7. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies

8. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	INTRODUCTION	6	10
2	SYMBOLS FOR JOINTS	9	13
3	FABRICATION DRAWING	6	24
4	STRUCTURAL DRAWING	7	9
5	PIPING AND PIPELINE DRAWINGS	8	19
	Total	36	75

9. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	Practical	Marks
1.	Practical Title	
1	Preparation of fabrication drawing from design drawing of simple truss with riveted joint	10
2	Preparation of fabrication drawing from design drawing of simple truss with welded joint	5
3	Drawing orthographic view, isometric view & detailed drawing of each member from assembly pictorial sketch of simple support made of rolled section with welded joints only	10
4	Preparing bill of material for simple support	5
5	Drawing orthographic view from isometric view of piping system	5
6	Drawing isometric view from orthographic view of piping system	5
7	Sketches based on topics 1, 2, 4, and 5	10
	Total	50
No	**Class room Assignments**	**Marks**
1	At least 10 covering all units above	
2		
...		
No	**Tutorial Exercise**	**Marks**
1	At least 10 problems on each unit given above	
2		

...	Total	

10. LEARNING RESOURCES

Text Books

S. No.	Author	Title of Books	Publishers
1	Hoelscher & Springer	Engg. Drawing and Geometry	John Willy & Sons Inc.
2	Milo S. Ketchum	Structural Engineers Handbook	Mc Graw Hill Book CO.
3	Thomas E. French and Charles J. Vierek	Engineering Drawing	-----
4	Warran J. Luzadder	Fundamental of Engg. Drawing	Prentice Hall of India

Reference Books for further study

S. No.	Author	Title of Books	Publishers
1	-------	I.S.I. Structural Engg. Handbook	-------

Indian and International codes needed

S. No.	Author	Title of Books	Publishers
1	-------	B.I.S Codes 800,813,696,806,801	-------

Instruction to Paper setter: SP 6(1); IS 800 Handbook is permitted during theory exam. (Please mention in question paper)

BASIC FABRICATION PROCESS (FB303)

1. COURSE OBJECTIVES / RATIONALE:

The technician engaged in Fabrication and Erection Industry is required to use a variety of measuring instruments during the manufacture and commissioning of jobs. He must also be well versed in the skill of marking of different types of sections and ensure proper alignment during their assembly and erection. He should possess the knowledge of metal sawing and flame cutting processes, which the metal 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.

2. PRE-REQUISITES:

Students should know

1. Engineering Drawing

3. TEACHING AND EXAMINATION SCHEME

Semester	**III**								
Course code & course title		**Periods/Week (in hours)**			**Total Hours**	**Examination Scheme**			
						Theory Marks		**Practical Marks**		**Total Marks**
(FB303) Basic Fabrication Process		**L**	**T**	**P**	**H**	**TH**	**TM**	**TW**	**PR**	
		3	0	2	5	75	25	25	25	150

4. COURSE OUTCOMES:

On successful completion of the course, the student will be able to:

FB303.CO1. Acquire the knowledge of measuring instruments, marking tools and basic metal cutting equipments.

FB303.CO2. Use various measuring, marking and basic metal cutting equipment to mark and cut steel

FB303.CO3. Select appropriate measuring, marking tools and basic metal cutting equipment for cutting steel as per requirement.

FB303.CO4. Cut Steel as per drawing within tolerances using appropriate measuring marking tools and basic metal cutting equipment

5. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CO 1	3	1	1	3	1	3	3
CO 2	3	1	1	3	1	3	3
CO 3	3	3	3	3	2	3	3
CO 4	3	3	3	3	3	3	3

Relationship : Low-1 Medium-2 High-3

	PSO1	PSO2
CO1	3	1
CO2	3	1
CO3	3	3
CO4	3	3

6. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	Thr = Teaching hours	CO = Course Objectives

Unit	M	Thr	CO
1 BASIC MEASUREMENT			
1.1 Introduction: Physical measurements, precision and accuracy, sources of errors, calibration of measurements. .	3	3	CO1, CO2, CO3, CO4
1.2 Standards of measurement: Introduction to standards, line standards, end standards, wavelength standards, angular standards.			CO1
1.3 Direct eye measurements. Linear Measurement: Engineer's rule, steel tape, use of steel rule and tape, possible error with eye measurement.			CO1, CO2, CO3, CO4
1.4 Vernier caliper: Principle of Vernier Caliper, application of Vernier caliper.	9	5	CO1, CO2, CO3, CO4
1.5 Vernier height gauge: Description, use of height gauge.			CO1, CO2, CO3, CO4
1.6 Micrometer (Internal and External): Principle of micrometer, use of micrometer.			CO1, CO2, CO3, CO4
1.7 Radius gauges. Feeler gauges. Wire and thickness gauge. Pitch gauge	3	2	CO1, CO2, CO3, CO4
1.8 Angular measurement: Engineer's Protractor, Vernier protractor, Universal Bevel protractor, use of spirit level for angular measurement. Right Angle Rule 3:4:5			CO1, CO2, CO3, CO4
	15	**10**	
2 ADVANCED MEASUREMENT			
2.1 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. .	3	2	CO1, CO2, CO3, CO4
2.2 Alignment testing: Use of tensioned wire.			CO1, CO2, CO3, CO4
2.3 Straightness testing: straight edge method, spirit level method.	3	2	CO1, CO2, CO3, CO4

2.4 Flatness testing: Comparison with flat surface, use of Ink on surface plate, use of spirit level.			CO1, CO2, CO3, CO4
2.5 Squareness testing: Engineer's square, block square, Method of testing	6	4	CO1, CO2, CO3, CO4
2.6 Roundness measurement: Fixture and dial indicator method.			CO1, CO2, CO3, CO4
2.7 Dial indicator- Dial indicator as a comparator, example.			CO1, CO2, CO3, CO4
2.8 Limit and fits: definitions: nominal size, zero line, actual size, limits, tolerance, fit and types of fits. ISO system of designation of limits and fits.	3	2	CO1, CO2, CO4
2.9 Limit gauges: Plain plug gauges, snap gauges and contour gauges.			CO1
	15	**10**	
3 MARKING			
3.1 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, uses of dividers. Beam trammels: Construction, use of beam trammels. Pencils. Ink markers. Angle plates. 'Vee' Block, Plate Square,Pipe square. Box angle plate, Adjustable swivel angle block, Nipple punch, Dot punch.	9	6	CO1, CO2, CO3, CO4
3.2 Marking method for large size plates. Methods of marking out bolt holes for flanges. Data for marking out pipe flanges, constant for bolt hole location (flanges), procedure for marking. Use of chalk line for marking long straight line, witness marks.	6	4	CO1, CO2, CO3, CO4
3.3 The need of templates for marking. 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).	3	2	CO1, CO2, CO4
3.4 Marking of hole in angle sections.	6	4	CO1, CO2, CO3, CO4

3.5 Marking a hole in channel sections.			CO1, CO2, CO3, CO4
3.6 Marking of holes in “Tee” sections.			CO1, CO2, CO3, CO4
3.7 Marking of holes in column or beams			CO1, CO2, CO3, CO4
3.8 Marking of cone (developed surface) without angle measuring instruments			CO1, CO2, CO3, CO4
	24	**16**	
4 METAL SAWING			
4.1 Reciprocating power hacksaw, use and safety	3	1	CO1, CO2, CO3, CO4
4.2 Abrasive cutting machine, use and safety			CO1, CO2, CO3, CO4
4.3 Circular metal saw, use and safety	6	3	CO1, CO2, CO3, CO4
4.4 Table sawing machine, use and safety			CO1, CO2, CO3, CO4
4.5 Band sawing machine, use and safety			CO1, CO2, CO3, CO4
	9	**4**	
5 INTRODUCTION TO FLAME CUTTING			
5.1 Basic principle of flame cutting.	3	2	CO1
5.2 Flame cutting equipment, Cutting oxygen pressure, fuel gas, Propane, natural gas, acetylene, LPG	3	2	CO1
5.3 Cutting torch details for each type of fuel gas. Nozzle mix cutting torch.	3	2	CO1
5.4 Flame adjustment: Procedure for lighting the cutting torch, adjustment of flame, procedure to extinguish the flame.	3	2	CO1, CO2,

5.5 Factors influencing the quality of cut			CO1, CO2, CO3, CO4
	12	**8**	
Total	**75**	**48**	**-**

7. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies

8. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit\	Number of lectures	Marks
1	BASIC MEASUREMENT	10	15
2	ADVANCED MEASUREMENT	10	15
3	MARKING	16	24
4	METAL SAWING	4	9
5	INTRODUTION TO FLAME CUTTING	8	12
	Total	48	75

9. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	Practical	Marks
1	Study of various measuring instruments mentioned in the syllabus (2 Practicals)	5
2	Measurement of actual parts with measuring instruments studied in Job1 (1 Practical)	
3	Study of various marking tools mentioned in the syllabus (2 Practicals)	5
4	Initial setting of Vernier Hight Gauge, Demonstration of Plumb line, Plumb Board, Water line, Tensioned wire, spirit level and Chalk line. (3 Practicals)	
4	Study of Power hacksaw machine, marking to exact length a given rolled section and cutting it on the power saw. (2 Practicals)	5
5	Marking of holes on job 4 to exact given dimensions and drilling the holes (1 Practical)	
6	Marking a wooden template of a given gusset plate sketch and marking the same on the steel plate (1 Practical)	5
7	Study of oxy- acetylene cutting set (1 Practical)	5
8	Exercise of opening the Flame cutting set, lighting the cutting torch, adjusting the Flame, putting off the torch, and closing the set (1 Practical)	
9	Practice of flame cutting on steel scrap (1 Practical)	
10	Cutting the marked gusset plate in Job6 with flame cutting and drilling the holes (1 Practical)	
	Total	25

10. LEARNING RESOURCES

Text Books

S. No.	Author	Title of Books	Publishers
1	S. K. Hajra Choudhury, A.K. Hajra Choudhury & Nirjhar Roy	Workshop Technology I	Media Promoters and Publisher Pvt. Limited
2	R. K. Jain	Engineering Metrology	Khanna Publishers
3	Smith F.J.M.	Basic Fabrication and Welding Engineer	Longman
4	Cooper K.J. and Greenwood	Technician Fabrication and Welding	Cassell series
5	Kenyon W.	Basic Welding and Fabrication	Pitman

Reference Books for further study

S. No.	Author	Title of Books	Publishers
1	Shotbolt C.R.	Technician Manufacturing Technology	Cassell series
2	A.D. Althouse, C.M. Turnquist, and W.A. Bowditch	Modern Welding	The Goodheart – Wilkox Company Inc, USA
3	Dave Smith.	Welding Skills and Technology	McGraw Hill book Company

ELECTRICAL ENGINEERING PRACTICE (FB 304)

1. COURSE OBJECTIVES / 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

2. PRE-REQUISITES:

Students should know
1. Applied Physics.

3. TEACHING AND EXAMINATION SCHEME

Semester	**III**								
Course code & course title		**Periods/Week (in hours)**			**Total Hours**	**Examination Scheme**			
						Theory Marks		**Practical Marks**	**Total Marks**
(FB304) Electrical Engineering Practice		**L**	**T**	**P**	**H**	**TH**	**TM**	**TW**	**PR**	
		0	0	2	2	-	-	25	50	75

4. COURSE OUTCOMES:

FB304.CO1. Choose appropriate symbol of various electrical components and equipments for drawing basic electrical circuit.
FB304.CO2. identify ac supply system ,various electrical lamps, starters, motors and transformers and make use of suitable electrical symbols to draw basic wiring diagram for domestic and industrial use.
FB304.CO3. Test wiring installation using appropriate method .
FB304.CO4. Estimate the energy bill for a given electrical load.

5. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CO 1	3	-	-	2	-	1	2
CO 2	2	1	1	2	1	2	2
CO 3	2	3	2	2	2	2	2
CO 4	2	-	2	1	1	-	2

Relationship : Low-1 Medium-2 High-3

	PSO1	PSO2
CO1	2	2
CO2	1	2
CO3	-	2
CO4	-	2

6. COURSE DELIVERY:
The Course will be delivered through lectures, class room interactions, exercises and case studies

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

Sr. No.	Description	Relevant CO
1	Study of Symbols of various Electrical Components.	CO1
2	Identification of Switches, Sockets, Switch Fuse and Fuse Switch Units, MCB, MCCB,ELCB and its practical applications.	CO1, CO2
3	Fuse and replacement of appropriate Fuse Wire in Switch Unit and HRC Fuse Switch Unit	CO1, CO2
4	Study of construction and working of D.C. Welding Generator.	CO1, CO2
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	CO1,CO2
6	Testing of Domestic wiring installation: a) Insulation Test between conductors. b) Insulation Test between Conductor and Earth. c)Continuity Test. e) Polarity Test.	CO3
7	i)Wiring Diagram for one fan, one light load and 3-pin socket outlet.	CO2
	ii)Wiring Diagram for Staircase Wiring	CO2
8	Study of Domestic and Industrial wiring system.	CO1, CO2
9	Estimation of Energy Bill for a domestic installation.	CO4
10	Estimation of Energy Bill for a industrial installation.	CO4
11	Connection of 1ø Transformer and measurement of Input and Output Quantities (V,I and W).	CO2
12	Study of construction and working of Welding Transformer	CO1, CO2
12	Starting a 1ø and 3ø induction Motor. Study of methods to reverse the direction of rotation.	CO1, CO2
13	Starting of 3Ø induction Motor using DOL/Star-Delta Starter and methods to reverse the direction of rotation.	CO1, CO2
14	Starting of DC motor using Four Point Starter.	CO1, CO2
15	Study of various Lamps used for Lighting such as Incandescent Lamp, Fluorescent Lamps,Mercury Vapor Lamp (HPMV) and Sodium Vapor Lamps (HPSV)	CO1, C02

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, symmetrically. Term end Practical Examination shall be conducted of 50 marks.

Reference Books for further study

S. No.	Author	Title of Books	Publishers
1	S.L.Bhatia	Electrical Engg. Hand Book	
2	Aurora	Electrical Wiring and Its Estimation	
3	B.L.Theraja	Textbook of Electrical Technology	

Indian and International codes needed

S. No.	Author	Title of Books	Publishers
1			
2			

Internet and Web Resources

S. No.	Author	Title of Books	Publishers
1			
2			

Videos and Multimedia Tutorials

S. No.	Author	Title of Books	Publishers
1			
2			

ADVANCED WELDING TECHNOLOGY (FB401)

1. COURSE OBJECTIVES / RATIONALE:

This subject is a continuation of Basic Welding Technology which covered various metal joining processes. The content included in this subject would enable the student to understand the commonly used welding process like GTAW, GMAW, SAW, FCAW and Resistance 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 during welding and cutting has been given due importance besides the topics on Jigs and Fixtures. Repair and maintenance welding have been included in order to enable the fabrication technicians to carry out repairs of components.

2. PRE-REQUISITES:

Students should know
1. Engineering Materials
2. Basic Engineering Practice
3. Basic welding technology

3. TEACHING AND EXAMINATION SCHEME

Semester	**IV**								
Course code & course title		**Periods/Week (in hours)**			**Total Hours**	**Examination Scheme**			
						Theory Marks		**Practical Marks**		**Total Marks**
(FB401) Advanced Welding Technology		**L**	**T**	**P**	**H**	**TH**	**TM**	**TW**	**PR**	
		3	0	4	7	75	25	25	25	150

4. COURSE OUTCOMES:

On successful completion of the course, the student will be able to:

FB401.CO1 Describe and Explain various welding processes
FB401.CO2 Select and Apply appropriate type of welding process to suit a specific application
FB401.CO3.Analyse various aspects of welding process and make necessary adjustments to the process to minimize adverse effects of various factors
FB401.CO4 Produce various types of joints in different positions in safe working conditions

5. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CO 1	3	1	1	1	1	1	1
CO 2	3	3	2	3	1	1	1
CO 3	3	3	3	3	1	1	1
CO 4	3	1	1	3	1	1	1

Relationship : Low-1 Medium-2 High-3

	PSO1	PSO2
CO1	3	1
CO2	3	3
CO3	3	3
CO4	3	3

6. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	Thr = Teaching hours	CO = Course Objectives

Unit	M	Thr	CO
1 ARC WELDING			
1.1 GTAW/TIG: Definition, Principle of Operation, Basic equipments, Polarity – Electrode positive & Electrode negative, Aluminium welding with AC, Shielding gas, GTAW Spot welding, Advantages, Limitations & Applications.	6	3	CO1, CO2, CO3, CO4
1.2 GMAW/MIG: Definition, Principle of Operation, Self adjusted arc, Self controlled arc, Basic equipments, Wire feed mechanism, Need for CO_2 gas pre heater in MAG welding, Advantages, Limitations & Applications.	6	3	CO1, CO2, CO3, CO4
1.3 SAW: Definition, Principle of Operation, Basic equipments, Effect of operating variables on weld quality & size, Weld backing, Advantages, Limitations & Applications.	6	3	CO1, CO2, CO3, CO4
1.4 FCAW: Definition, Principle of Operation (self shielded & gas shielded), Basic equipment, Manufacture of flux cored electrode wires, Advantages, Limitations, Applications, Comparison of FCAW with SAW & GMAW.	6	3	CO1, CO2, CO3, CO4
2 RESISTANCE WELDING			
2.1 Definition, Process fundamentals	3	1	CO1
2.2 Spot welding: Definition, Principle of operation, Heat shrinkage, Heat balance, Advantages, Disadvantages, Applications. Seam welding: Definition, Principle of operation, Advantages, Disadvantages & Applications.	4	3	CO1, CO2, CO3, CO4
2.3 Projection welding: Definition, Principle of operation, Advantages, Disadvantages & Applications.	3	1	CO1, CO2, CO3, CO4
2.4 Resistance Butt / Upset Welding: Definition, Principle of operation. Flash Butt welding: Definition, Principle of Operation, Difference between Upset & Flash butt welding, Advantages, Disadvantages, Applications.	4	2	CO1, CO2, CO3, CO4
3 METALLURGY OF WELDING			
3.1 Absorption of gases by welds: Sources of gas, Effects of gas absorption (H_2,N_2,O_2), Prevention of gaseous contamination.	3	1	CO3
3.2 Thermal effects of welding on parent metal and its mechanical properties. Importance of Carbon Equivalent.	3	1	CO3
3.3 Hydrogen Embrittlement and cracking. Concept of Weld cracking & Weld decay	3	1	CO3
3.4 Corrosion of Welds: Definition, Types – Direct, Electromechanical, Galvanic & Liquid- Metal, Factors influencing corrosion resistance of welded joints.	3	2	CO3
4 DISTORTION AND STRESS RELIEF			
4.1 Concept of distortion & residual stresses. Types of distortion: Longitudinal, Transverse, Angular, Bowing. Causes of distortion: Heat Input, Restraint, Inherent stresses in parent metal.	3	2	CO3, CO4

4.2 Control of distortion: joint design, assembly procedure, welding procedure, welding sequence, welding techniques. Correction of distortion: Mechanical techniques & Thermal techniques.	3	2	CO3, CO4
4.3 Welding Heat treatment: Pre Heat treatment & Post Heat treatment	3	1	CO3, CO4
4.4 Stress relief: Purpose, Methods – Peening, Vibratory stress relief, Thermal treatment, Thermo- Mechanical stress relief treatment, Overstressing technique.	4	2	CO3, CO4
5 **REPAIR AND MAINTENANCE WELDING**			
5.1 Weldability & Weldability testing. Welding Robots & Welding Automation. Procedure of maintenance welding, Welding Jigs & fixtures.	6	2	CO1, CO3, CO4
5.2 Examples of repair works- Repair of hair-line crack in casting, Rebuilding of worn-out shafts, Hard Facing of worn out surfaces.	6	3	CO3, CO4
Total	**75**	**36**	-

7. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies

8. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	ARC WELDING	12	24
2	RESISTANCE WELDING	7	14
3	METALLURGY OF WELDING	5	12
4	DISTORTION AND STRESS RELIEF	7	13
5	REPAIR AND MAINTENANCE WELDING	5	12
	Total	36	75

9. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	Practical	Marks
1.	Practical Title	
1	Perform MMAW in Horizontal position i. Practice for striking arc and obtaining weld bead on plate ii. Weld Pad building iii. Square butt, V-butt Joint, Lap joint & Tee joint v. Pipe to pipe & Pipe to plate	10
2	Perform MMAW in Overhead position i. Practice for striking arc & obtaining weld bead on plate ii. Weld Pad building iii. Square butt, V-butt Joint, Lap joint & Tee joint v. Pipe to pipe & Pipe to plate	10
3	Study of TIG welding equipment Perform GTAW in Flat position i. Running fusion runs without filler & Running beads with filler rod ii. Square butt joint of thin plates without filler & with filler rod	10
4	Study of MIG welding equipments Perform GMAW in Flat position	10

	i. Running beads ii. V-Butt joint	
5	Demonstration of Distortion control & Correction in weldment	10
6	Demonstration of Repair & Maintenance welding	
7	Demonstration of other welding process by visit to industry	
	Total	50
No	**Class room Assignments**	**Marks**
1	At least 10 covering all units above	
No	**Tutorial Exercise**	**Marks**
1	At least 10 problems on each unit given above	
2		
...	Total	

10. LEARNING RESOURCES

Text Books

S. No.	Author	Title of Books	Publishers
1	O. P. Khanna	A text- Book of Welding Technology	Dhanpat Rai & Sons , Delhi
2	A.C. Davis	The Science & Practice of Welding Vol-I & II	Cambridge University Press
3	S V Nadkarni	Modern Arc Welding Technology	Advani- Oerlikon Ltd

Reference Books for further study

S. No.	Author	Title of Books	Publishers
1	-----	Metal Handbook: Vol-VI ASM (Welding, Brazing & Soldering)	------
2	-----	Control of distortion in Welding Fabrication, 2nd Edition,	Welding Institute, London
3	------	Welding Handbook	AWS, Section-I
4	-----	Welding Journals	Indian Institute of Welding and American Welding Society
5	------	Welding Hand: Book Vol -I to V	American Welding society,550,N.W.Le. Jeune Road P.O.Box 351040 Miami FL33135

ADVANCED FABRICATION PROCESS (FB 402)

1. COURSE OBJECTIVES / RATIONALE:

This course is a continuation of the course on Basic Fabrication Processes. This course lays stress on straightening and cutting operations, both manual and by using machinery. Operations of drilling, milling, shaping and grinding are included in this course as they also fall under the broad category of cutting of metals. This course is intended to bring the students face to face with industrial fabrication situations, enabling him to develop an appreciation of the real life experiences, which he would encounter in his day to day work.

2. PRE-REQUISITES:

Students should know
1. Basic Fabrication Processes

3. TEACHING AND EXAMINATION SCHEME

Semester	**IV**								
Course code & course title		**Periods/Week (in hours)**			**Total Hours**	**Examination Scheme**			
						Theory Marks		**Practical Marks**		**Total Marks**
(FB 402) Advanced Fabrication Process		**L**	**T**	**P**	**H**	**TH**	**TM**	**TW**	**PR**	
		3	0	4	7	75	25	25	25	150

4. COURSE OUTCOMES:

On successful completion of the course, the student will be able to:
FB402.CO1. Acquire the knowledge of Straightening and advanced metal cutting equipments.
FB402.CO2. Use various advanced metal cutting equipment to cut steel
FB402.CO3.Select appropriate advanced metal cutting equipment for cutting steel as per requirement.
FB402.CO4. Cut Steel as per drawing within tolerances using appropriate advanced metal cutting equipment.

5. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CO 1	3	1	1	1	1	3	3
CO 2	3	1	1	3	1	3	3
CO 3	3	3	3	1	2	3	3
CO 4	3	3	3	3	3	3	3

Relationship : Low-1 Medium-2 High-3

	PSO1	PSO2
CO1	1	1
CO2	1	1
CO3	2	2
CO4	3	3

6. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	Thr = Teaching hours	CO = Course Objectives

Unit	M	Thr	CO
1 PRINCIPLES OF METAL CUTTING			
1.1 Principle of shearing: shearing angle, rake angles of blades, clearance between cutting edges.	6	4	CO1
1.2 Straight-line cutting machines (brief description): Bench shearing machine, treadle guillotine machine, power guillotine machine, Mechanical and Hydraulic	3	2	CO1, CO2, CO3, CO4
1.3 Types of rotary shearing machines: Parallel Shaft machine, inclined shaft machine.	3	2	CO1, CO2, CO3, CO4
1.4 Portable Nibblers: Shear type and Punch type.			CO1, CO2, CO3, CO4
1.5 Meaning of Cropping and Notching. Necessity for notching in angle sections.	6	4	CO1
1.6Universal Steel Shearing Machine for cropping angles, Tee, round, square bars, punching holes and cutting notches.			CO1, CO2, CO3, CO4
	18	**12**	
2 FLAME CUTTING- APPLICATIONS			
2.1 Need for straightening of structural members	3	1	CO1
2.2 Methods of straightening: Mechanical straightening, Manual straightening, Straightening with heat			CO1
2.3 Straightening with heat: Principle, Heat triangles, Heat strips, examples	3	1	CO1
2.4 Technique of cutting thick plates near edges.	3	3	CO1, CO2, CO3, CO4
2.5 Technique of cutting away from edge.			CO1, CO2, CO3, CO4
2.6 Technique of cutting of round bar.			CO1, CO2, CO3, CO4
2.7 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.	3	3	CO1, CO2, CO3, CO4

2.8 Rivet removal.	3		CO1, CO2, CO3, CO4
2.9 Removal of defective weld by gouging.			CO1, CO2, CO3, CO4
	15	**8**	
3 CUTTING MACHINES I			
3.1 Centre lathe - Function of the lathe, parts of lathe, Lathe operations: straight turning, taper turning, chamfering, Thread cutting, Grooving, Facing, Knurling, Cutting speed, feed, Depth of cut.	6	4	CO1, CO2, CO3, CO4
3.2 Drilling machines - Portable drilling Machine, sensitive drilling Machine, Radial Drilling Machine, Work holding devices: T- bolt and clamps, Drilling Vise. Tool holding Devices: Drill chuck, Morse standard Taper sleeves, Drift. Drilling Machine Operations: Drilling, Reaming, Boring, Counter boring, Countersinking, spot facing, Trepanning.	6	4	CO1, CO2, CO3, CO4
3.3 Boring Machines: Horizontal, vertical, precision, and Jig boring machines.	3	2	CO1, CO2, CO3, CO4
3.4 Grinding machines - Types of Grinding: Rough & Precision grinding. Rough Grinding machines: Floor stand and bench grinders, Portable and flexible shaft grinders, swing frame grinders, abrasive belt grinders. Precision grinding: Surface grinding, Cylindrical grinding; Centre & Centreless, Grinding wheel specifications.	6	4	CO1, CO2, CO3, CO4
	21	**14**	
4 CUTTING MACHINES II			
4.1 Milling machine - 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	6	4	CO1, CO2, CO3, CO4
4.2 Shaping - Working of Crank type Standard Shaper. Principal Parts, Whitworth quick return mechanism, Adjusting the length of stroke, adjusting the position of stroke, Work holding devices: shaper Vises, Parallels, Hold downs, shaper operations	6	4	CO1, CO2, CO3, CO4
4.3 Planning Machine: Planning Machine Parts, planer operations	3	2	CO1, CO2, CO3, CO4
	15	**10**	
5 SPECIAL CUTTING AND BEVELLING MACHINES			
5.1 Principle and Working of plasma arc cutting & Laser cutting of steel.	3	2	CO1, CO2, CO3, CO4

5.2 C.N.C .steel profile cutting Machines (Brief Description)	3	2	CO1, CO2, CO3, CO4
5.3 Plate edge preparation machines (Bevellers).			CO1, CO2, CO3, CO4
5.4 Pipe end bevelling machines.			
	6	**4**	
Total	**75**		-

7. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies

8. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	PRINCIPLES OF METAL CUTTING	12	18
2	FLAME CUTTING- APPLICATIONS	8	15
3	CUTTING MACHINES I	14	21
4	CUTTING MACHINES II	10	15
5	SPECIAL CUTTING AND BEVELLING MACHINES	4	6
	Total	48	75

9. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	Practical	Marks
1	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.	5
2	One simple turning job involving operations like facing, stepping turning, taper turning and threading.	
3	One shaping job involving straight and inclined shaping of a block.	5
4	One milling job involving plain and angle milling of 10mm thick plate piece.	5
5	Practice of bevelling of edges by Hand flame cutting and drilling of holes as per drawing.	5
6	One job involving marking, shearing and drilling a Gusset plate as per drawing.	
7	Practice of cutting 2mm thick sheet on a marked contour by using portable nibbling machine.	5
8	Setting of guillotine (demonstration),	
9	Operations on the guillotine (demonstration).	
	Total	25

10. LEARNING RESOURCES

Text Books

S. No.	Author	Title of Books	Publishers

1	S. K. Hajra Choudhury, A.K. Hajra Choudhury & Nirjhar Roy	Workshop Technology II	Media Promoters and Publisher Pvt. Limited
2	Smith F.J.M	. Basic Fabrication and Welding Engineer	Longman.
3	Cooper K.J. and Greenwood	Technician Fabrication and Welding	Cassell series
4	Dave Smith.	Welding Skills and Technology	McGraw Hill Book Company
5	S. K. Hajra Choudhury, A.K. Hajra Choudhury & Nirjhar Roy	Workshop Technology II	Media Promoters and Publisher Pvt. Limited

Reference Books for further study

S. No.	Author	Title of Books	Publishers
1	Kenyon W.	Basic Welding and Fabrication	Pitman
2	Shotbolt C.R.	Technician Manufacturing Technology	Cassell series
3	----	Machine Manuals from Manufacturers	-----

TREATMENT ON STEEL (FB 403)

1. COURSE OBJECTIVES / RATIONALE:

A Technician in fabrication is involved in the fabrication, repairs and maintenance of various types of structures in the industries and should have knowledge of steel surface preparation and protection. This course is designed to enable students to understand the process of heat treatment, stress relieving processes and metallurgical aspects of welds.

2. PRE-REQUISITES:

Students should know
1. Engineering Materials

3. TEACHING AND EXAMINATION SCHEME

Semester	**IV**								
Course code & course title		**Periods/Week (in hours)**			**Total Hours**	**Examination Scheme**			
						Theory Marks		**Practical Marks**	**Total Marks**
(FB 403)		**L**	**T**	**P**	**H**	**TH**	**TM**	**TW**	**PR**	
Treatment of Steel		3	0	0	3	75	25	-	-	**100**

4. COURSE OUTCOMES:

On successful completion of the course, the student will be able to:

FB403.CO1. Describe and Explain manufacturing of steel, heat treatment on steel, steel surface preparation and steel protection.
FB403.CO2. Apply the knowledge to produce defect free weldments
FB403.CO3. Analyse factors affecting mechanical properties and effect of alloying elements on steel
FB403.CO4. Select appropriate steel surface preparation and protection methods as per application

5. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CO 1	2	1	1	1	1	1	1
CO 2	3	2	1	1	1	1	1
CO 3	3	1	1	1	1	1	1
CO 4	3	3	3	3	1	1	1

Relationship : Low-1 Medium-2 High-3

	PSO1	PSO2
CO1	1	1
CO2	2	1
CO3	3	3
CO4	3	3

6. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	Thr = Teaching hours	CO = Course Objectives

Unit	M	Thr	CO	Levels
1 STEEL MAKING(Brief Description)				
1.1 Pig iron and its manufacture: Blast furnace.	4	2	CO1	1,2
1.2 Steel and its manufacture : Bessemer Process , L-D process, Direct Electric Arc Furnace Process.	4	2	CO1	1,2
2 ALLOYING ELEMENTS				
2.1 Iron- Carbon equilibrium diagram (steel portion upto 2%C only) ,Types of solid solutions: Substitutional, Interstitial, Types of structures: Pearlite, Austenite, Cementite, Martensite	9	4	CO1	1,2
2.2 Effect of alloying elements on steel: Carbon, Silicon, Manganese, Sulphur, Phosphorous.	6	2	CO3	1,2,3
2.3 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	2	CO3	1,2,3
3 HEAT TREATMENT ON STEEL				
3.1 Definition & Need of heat treatment. Factors affecting good results: heating temperature, soaking time, rate of cooling. Quenching media: water, oil, brine and air.	4	3	CO1 CO2	1,2,3
3.2 Hardening process: Purpose, Heating method- Furnaces, Salt bath and induction. Tempering Process: Purpose, effects and types of tempering. Normalising process: Purpose, effects and methods of normalising. Annealing process: Purpose, full annealing, process annealing. Martempering process and Austempering process. Recovery, Re crystallization & Grain growth.	15	8	CO1 CO2	1,2,3
4 STEEL SURFACE PREPARATION				
4.1 Mechanical cleaning of steel: Shot blasting, Sand blasting, Hydro blasting, Barrel tumbling, Rotary blasting.	6	3	CO1 CO4	1,2,3
4.2 Chemical cleaning of steel: Degreasing, Descaling, Acid pickling, Electrolyte cleaning, Electrolytic degreasing and Electrolytic pickling of steel	6	3	CO1 CO4	1,2,3
5 PROTECTION OF STEEL				
5.1 Cathodic and Anodic protection of steel: Basic theory, Cathodic protection, Sacrificial anode protection and Impressed Current Cathode protection (ICCP)	6	3	CO1 CO4	1,2,3,4
5.2 Protection by Barrier Coatings: Requirement of coatings, Painting, Powder coating, Galvanizing, Phosphating, Zinc plating, Chrome plating.	9	4	CO1 CO4	1,2,3,4
Total	**75**	36	-	

7. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies

8. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	STEEL MAKING(Brief Description)	4	6
2	ALLOYING ELEMENTS	8	23
3	HEAT TREATMENT OF STEEL	11	19
4	STEEL SURFACE PREPARATION	6	12
5	PROTECTION OF STEEL	7	15
	Total	36	75

9. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	Practical	Marks
1.	Practical Title	
	Total	
No	**Class room Assignments**	**Marks**
1	At least 10 covering all units above	
2		
...		
No	**Tutorial Exercise**	**Marks**
1	At least 10 problems on each unit given above	
2		
...	Total	

10. LEARNING RESOURCES

Text Books

S. No.	Author	Title of Books	Publishers
1	S. K. Hajra	Materials and Processes	Choudhary India Book Distributing co. Calcuta
2	O. P. Khanna	Welding Technology	Dhanpat Rai and Sons , Delhi
3	Eric M. Simons	The Surface Treatment of steel	----
4	G.A. Balalaev	Corrosion Prevention Practice	-----
5	Dr. O.P. Khanna	Material Science and Metallurgy	-----
6	R.A. Higgins ELBS Edward Arnold	Engineering Metallurgy Part I	-----

Reference Books for further study

S. No.	Author	Title of Books	Publishers
1	-----	Vol. 11- Non- Destructive Inspection and quality Control	American Society of Metals Hand Book

MECHANICS OF SOLIDS (FB 404)

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1. COURSE OBJECTIVES / 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 the understanding of which is of vital importance.

2. PRE-REQUISITES:

Students should have knowledge of

1. Engineering Maths-I & Engineering Maths-II
2. Engineering Mechanics

3. TEACHING AND EXAMINATION SCHEME

Semester	**IV**								
Course code & course title		**Periods/Week (in hours)**			**Total Hours**	**Examination Scheme**			
						Theory Marks		**Practical Marks**		**Total Marks**
(FB 404) Mechanics of Solids		**L**	**T**	**P**	**H**	**TH**	**TM**	**TW**	**PR**	
		3	0	1	4	75	25	25	-	125

4. COURSE OUTCOMES:

On successful completion of the course, the student will be able to:

FB404.CO1. State the behaviour of the materials under different loading conditions.

FB404.CO2. Understand the concept of centre of gravity, centroid, moment of inertia of sections, shear force and bending moment and its effects in beams.

FB404.CO3.Analyzing beams to plot shear force and bending moment diagrams.

FB404.CO4. Compute stresses & strains in bars, columns, beams and cylindrical shells

5. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CO 1	3	3	2	3	3	1	2
CO 2	3	3	1	---	----	---	----
CO 3	3	3	1	----	-------	-----	----
CO 4	3	3	2	2	2	---	2

Relationship : Low-1 Medium-2 High-3

	PSO1	PSO2
CO1	3	--
CO2	3	2
CO3	3	--
CO4	3	--

6. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	**Thr = Teaching hours**	**CO = Course Objectives**			
Unit			**M**	**Thr**	**CO**
1 Stress , Strains and Strain Energy					
1.1 Definition of rigid, elastic and plastic bodies, deformation, internal resistance, stress and strain due to axial loading of tension, compression, stress strain relationship, concept of Biaxial and Tri-axial stress (No derivations & numerical problems)			3	3	CO1
1.2. Concept of shear loading and deformation, shear stress, shear strain, modulus of rigidity. Longitudinal strain, lateral strain, Poisson's ratio, , 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. (Theory + Numerical problems)			12	15	CO1
1.3 Concept and definition of strain energy. Strain energy stored due to gradual, sudden and impact loading, proof resilience and modulus of resilience. .(Theory + Numerical problems)			6	3	CO1
2 Centroid, Centre of Gravity & Moment of Inertia					
2.1 Definition of Centroid & Definition of Centre of Gravity 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.			6	3	CO2
2.2 Determination of Centroid of plane regular lamina, cut-outs and built-up lamina as well as regular solids a well as built up solids ,Moment of Inertia of sections –Angle section, I section, Channel, Tee section and built up section			6	7	CO2
3 Shear Force and Bending Moment					
3.1 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			3	03	CO3
3.2 Shear .Force.and Bending.Moment.Diagrams. for cantilever, simply supported and overhanging beams subjected to point loads, uniformly distributed loads and moments determining point of contra flexure.			12	09	CO3
4 Bending & Shear Stresses in Beams					
4.1 Theory of simple bending assumptions made in theory of simple bending, , Neutral plane, neutral-axis, , stress and strain due to bending. moment of resistance, bending stress diagrams. Flexural rigidity, beam of maximum strength and beam of uniform strength , Section modulus for rectangular, circular and Symmetrical I section			06	04	CO3
4.2 Calculation of maximum bending stress in beams of rectangular, circular, I and T section, Permissible bending stress,			06	8	CO3
4.3 Shear Stress Distribution in Beams of rectangular, circular, I and T section, Permissible bending stress,			06	4	CO3
5 Thin and Thick cylinders					
5.1 Definition of thin cylindrical shell, Definition of thick cylindrical shells,			3	1	CO4
5.2 Stresses in thin cylindrical shell, rivetted shell, stresses in thin spherical shells. Stresses in thick cylindrical shell and pressure distribution			6	5	CO4
Total			**75**		-

7. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies

8. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	Stresses and strains	18	21
2	Centroid, Centre of Gravity & Moment of Inertia	12	12
3	Shear Force and bending Moment	12	15
4	Bending Stresses & Shear Stresses in Beam	16	18
5	Thin and Thick Cylinders	6	9
	Total	64	75

9. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	Practicals	Marks
1	Tension test on mild steel	15
2	Compression test on concrete, timber & brick	
3	Charpy test & Izod Test	
4	Breinell hardness test & Rockwell hardness test	
5	Shear test on mild steel specimen	
6	Bend test	
7	Four Half Imperial Drawing Sheets to: Plot Shear Force and Bending Moment diagrams for simply supported, cantilevers, and overhanging beams subjected to point loads and uniformly distributed loads with analytical calculations.	10
	Total	25

10. LEARNING RESOURCES

Text Books

S. No.	Author	Title of Books	Publishers
1	S.B. Junnarkar	Mechanics of Structures volume-I	Charotar Publishing House, Anand, Gujrat
2	S. Ramamrutham	Strength of Materials	Dhanpat Rai & Sons, New Delhi
3	R.S. Khurmi	Strength of Materials	S Chand
4	Chakraborty	Strength of Materials	

Reference Books for further study

S. No.	Author	Title of Books	Publishers
1	S S Bhavikatti	Strength of Materials	Vikas Publishing House Pvt. Ltd, Noida (UP)
2	Vazirani and Ratwani	Analysis of Structures	Khanna Publishers, New Delhi
3	Timoshenko	Strength of Materials	Tata McGraw Hills

Internet and Web Resources

S. No.	Author	Title of Books	Publishers
1	MIT Open Courseware	Mechanics of Materials	https://ocw.mit.edu
2	reddit	Learning Resource for Solid Mechanics	https://www.reddit.com

Videos and Multimedia Tutorials

S. No.	Author	Title of Books	Publishers
1	NPTEL	Mechanical Engineering – Strength of Materials	https://nptel.ac.in

(MC304) COMPUTER AIDED DRAFTING

1. Rationale: The market driven economy demands frequent changes in product design to suit the customer needs and the introduction of drafting and designing softwares in manufacturing has made the task of incorporating frequent changes as per requirement easier. This course will make the student capable of creating, editing and plotting quality CAD drawings using CAD software.

2. PRE-REQUISITES:
Basics of Computer Knowledge and Engineering Drawing

3. TEACHING AND EXAMINATION SCHEME

Course Code & Course Title	Periods/ Week (In Hours)			Total Hours	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
(MC304) Computer Aided Drafting	L	T	P	H	TH	TM	TW	PR	100
	0	0	4	4	-	-	50	50	

4. COURSE OUTCOMES:
On successful completion of the course, the student will be able to:
MC304.CO1: Identify the various toolbars and commands of CAD software.
MC304.CO2: Prepare a 2D drawing using the CAD software.
MC304.CO3: Develop a simple 3D Model using the CAD software.
MC304.CO4: Plot/Print the 2D and 3D drawing.

5. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CO1	1	1	3	2	3	3	3
CO2	2	3	3	1	2	2	3
CO3	2	3	3	1	2	2	3
CO4	2	2	3	1	3	2	3

Relationship : Low-1 Medium-2 High-3

	PSO1	PSO2
CO1	1	1
CO2	2	3
CO3	3	3
CO4	1	1

1. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	**Phr = Practical hours**	**CO = Course Outcomes**			
Unit			**M**	**Phr**	**CO**
1 **Introduction and CAD Preliminaries.**			**-**	**2**	**CO1**
1.1 Computer aided drafting concept.					
1.2 Hardware and various CAD software available					

1.3 Components of a CAD software such as various toolbars in respective software's			
1.4 File features Management: (like New file, Saving the file, Opening, Import and Export of file)			
1.5 Setting up the CAD environment			
2 Drawing, Editing, Modifying and organizing 2D drawing:	-	**28**	**CO2**
2.1 Drawing basic geometric elements			
2.2 All View Commands: (like Zoom all, Zoom Previous, Zoom Extents, zoom window, zoom real time, Zoom Dynamic, Zoom Pan)			
2.3 All Modify commands / Transformation commands: such as Mirror, Array, Move, Scale, Trim, chamfer, fillet.			
2.4 Concepts of layers and blocks.			
3 Dimensioning and Tolerancing	-	**12**	**CO2**
3.1 Dimensioning: Types of dimensioning, Linear, Horizontal, Vertical, Aligned, rotated, Baseline, continuous, diameter, radius, angular dimension, Leader.			
3.2 Dimension scale variable, adding geometric tolerances			
3.3 Editing dimensions			
3.4 Text styles: selecting font, size, arrows, alignment, line text, Multiline text.			
4 Solid Modelling	-	**16**	**CO3**
4.1 3D features such as understanding co-ordinate system, Viewing in 3D			
4.2 Concept of solid modelling			
4.3 Creating predefined solid primitives such as box, cone, cylinder, sphere, torus, wedge.			
4.4 Creating an extruded solid, creating a revolved solid.			
4.5 Creating composite solids			
4.6 Rendering			
5 Model space, Paper space, viewports, layouts & Printing/Plotting	-	**6**	**CO4**
5.1 Concept of model space and paper space			
5.2 Creating viewports in model space and creating floating viewport in paper space.			
5.3 Shifting from model space to paper space and vice versa.			
5.4 Selecting various plotting parameters such as paper			

size, paper units, drawing orientation, plot scale, plot offset, plot area, print preview.			
Total	**50**	**64**	

7. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies

8. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

No	Practical	Marks
1.	Drafting of common template for all the following assignments with Institute logo and standard title block.	----
2.	At least Five problems on different geometrical shapes using basic commands.	----
3.	At least Three problems with transformation features.	----
4.	Two problems on orthographic views for various Engineering drawing objects covering dimensioning, text.	----
5.	Create at least two solid models, which cover all the features available in solid modelling.	----
6.	Drafting project: a) Civil Engg. & Architectural Engineering: Plan, elevation and section of a single-story residential building. b) Electrical & Electronics and Allied Engg. Branches: Electrical layout of components like bulbs, fan, A.C., T.V. point, telephone point, etc. for a single-story house. c) Mechanical and Allied Engg. Branches: Industrial components such as machines, automobiles, jigs and fixtures with dimensioning, tolerancing, text, title block, Assembly etc. d) Shipbuilding Engg. Body plan of a ship. e) 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)	----
	Total	50

9. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	Practical	Marks
1.	Drafting of common template for all the following assignments with Institute logo and standard title block.	----
2.	At least Five problems on different geometrical shapes using basic commands.	----
3.	At least Three problems with transformation features.	----
4.	Two problems on orthographic views for various Engineering drawing objects covering dimensioning, text.	----
5.	Create at least two solid models, which cover all the features available in solid modelling.	----
6.	Drafting project: a) Civil Engg. & Architectural Engineering: Plan, elevation and section of a single-story residential building.	----

	b) Electrical & Electronics and Allied Engg. Branches: Electrical layout of components like bulbs, fan, A.C., T.V. point, telephone point, etc. for a single-story house. c) Mechanical and Allied Engg. Branches: Industrial components such as machines, automobiles, jigs and fixtures with dimensioning, tolerancing, text, title block, Assembly etc. d) Shipbuilding Engg. Body plan of a ship. e) 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)	
	Total	50

10. LEARNING RESOURCES

Text Books

S. No.	Author	Title of Books	Publishers
1	P. Nageshwar Rao	AutoCAD for Engineering drawing made easy – P. Nageshwar Rao- Tata McGraw Hill.	Tata McGraw Hill.
2	Sagar Linkan	AutoCAD 2018 training Guide	BPB Publications
3			
4	Sham Tickoo	PRO/ Engineer PTC creo parametric 3.0	Dreamtech Press (2015)
5	Sham Tickoo	Solid Works 2018	BPB Publication
6	Nader G. Zamani.	CATIA V5 Tutorials	SDC Publications

Reference Books for further study

S. No.	Author	Title of Books	Publishers
1	Sham Tickoo	Pro/ENGINEER Wildfire 5.0 for Designers	CADCIM Technologies
2	Sham Tickoo	AutoCAD 2019: A problem Solving Approach	BPB Publication
3	George Omura	Mastering AutoCAD	BPB Publication
4	Sham Tickoo	CATIA V5-6R2017 for Designers 15th Revised Edition	BPB Publication

ELEMENTS OF CIVIL ENGINEERING (FB405)

1. COURSE OBJECTIVES / RATIONALE:

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

2. PRE-REQUISITES:

Students should know
1. Engineering Mathematics
2. Engineering Materials

3. TEACHING AND EXAMINATION SCHEME

Semester	**IV**								
Course code & course title		**Periods/Week (in hours)**			**Total Hours**	**Examination Scheme**			
						Theory Marks		**Practical Marks**		**Total Marks**
(FB405) Elements of Civil Engineering		**L**	**T**	**P**	**H**	**TH**	**TM**	**TW**	**PR**	
		3	0	2	5	75	25	25	-	125

4. COURSE OUTCOMES:

On successful completion of the course, the student will be able to:

FB405.CO1. State the basic principles of engineering surveying, types of structures, foundations, super structure , finishing's, roofs and methods of fire protection and sound insulation .

FB405.CO2. Understand the use of surveying equipments like chain, tape, Compass, Dumpy Level and Theodolite. and Construction activity of buildings and steel structures .and the basics of Building drawings .

FB405.CO3. Undertake setting out work of building/steel structure, supervise construction activity /erection of steel structures from drawings.

FB405.CO4. Plan two room building

5. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CO 1	3	2	---	2	3	1	2
CO 2	3	2	1	2	3	1	2
CO 3	3	3	1	2	3	3	2
CO 4	2	1	1	---	--	---	1

Relationship : Low-1 Medium-2 High-3

	PSO1	PSO2
CO1	3	1
CO2	3	1
CO3	3	3
CO4	2	1

6. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	**Thr = Teaching hours**	**CO = Course Objectives**			
Unit			**M**	**Thr**	**CO**

1 Surveying			
1.1 Content Definition of surveying, object of surveying, uses of surveying, principle of Surveying, classification of surveying.	6	5	CO1
1.2 Methods of linear measurements, instruments for Linear measurement			
1.3 Ranging:- Direct and Indirect (Reciprocal) Ranging			
1.4 Measurement of distances with chain, tape and other instruments.			
1.5 Chaining long a sloping line, to continue a line, measurement of the distance past an obstacle like building, valley etc.			
2 Compass Surveying			
2.1 Introduction and purpose, definitions: Geographic Meridian, Magnetic Meridian, Arbitrary Meridian	6	5	CO1,CO2
2.2 Knowledge of Bearings i) Whole circle Bearing ii) Quadratic of Reduced Bearing, study and use of Prismatic Compass. Local attraction, Fore bearing and Back bearing, computation of included angles.			
3 Levelling			
3.1 Definition of technical in concept of leveling, A level line and a horizontal line, 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	6	8	CO1 , CO2
3.2 Calculation of reduced levels in a Levelling book by:)(i) H.I. method (ii) Rise and fall method	6	4	CO2
4 Theodolite Surveying			
4.1 Introduction of theodolite, definition of technical terms in theodolite surveying: Line of collimation, Transiting, swinging, Face lf and Face right observations, Study of a Transit theodolite and its parts.	9	10	CO2
4.2 Temporary adjustment of theodolite			
4.3 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			
5 Building Construction			
5.1 Types of buildings: Load bearing and framed structures.	3	2	CO3
5.2 Components of building: Foundations, walls, columns, beams and slabs, roofs, flooring.			
5.3 **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, at in situ piles an precast piles, cased and uncased piles, Caissons.	6	4	CO3
5.4 Flooring: - Types of floorings, flooring for Residential buildings, Office buildings, Factories, workshops and ware houses, Auditorium.	3	2	CO3

5.5 Roofs and Roofs coverings: - Classification of roofs: Flat and pitched roofs. Roof 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.	6	2	CO3
5.6 Fire Protection: - Fire resisting construction. Fire protection requirement/ Measures for multi store building and Industries Insulation in Building: - Thermal insulation-material used, Sound insulation-materials used Acoustical design of auditorium.	4	2	CO3
6 **Concrete Technology**			
6.1 Types of Concrete, Ingredients of Concrete, Grades/ Mix proportions of Concrete for various purposes.	8	4	CO3
6.2 Concreting: mixing, transporting, placing, compacting, curing, importance of water cement ratio.			
6.3 Concept of RCC, Pre-stressed Concrete. Grouting and its use			
7 **Building Drawing**			
7.1 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	12	CO4
Total	**75**		-

7. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies

8. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	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

9. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	Practical	Marks
1	Measurement of distance with chain	15
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	
9	Report on different types of foundation with sketches	10
10	Line diagram of various roof trusses	
11	Plan, elevation, sectional view of a building	
	Total	25

10. LEARNING RESOURCES

Text Books

S. No.	Author	Title of Books	Publishers
1	B.C. Punmia	Surveying Vol I & II	Laxmi Publication Ltd.
2	N.N. Basak	Surveying & Levelling	Mc. Graw Hill Education
3	Sushilkumar	Building Construction	Standard Publishers and Distributers
4	S. Ramamruthum	Building Construction	Dhanpat Rai & Son
5	Kale & Patki	Building Drawing (V Edition)	Tata Mc. Graw Hill education

Reference Books for further study

S. No.	Author	Title of Books	Publishers
1	S.C. Rangawala	Building Construction	Charotar Publishers
2	S.K.Duggal	Surveying Vol I & II	Mc.GrawHill Education
3			

(FB 501) FABRICATION INPLANT TRAINING – Phase -I

1. COURSE OBJECTIVES

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.

2. TEACHING AND EXAMINATION SCHEME

Semester	V			
Course code &		Periods/Week	Total	Examination Scheme

course title	(in hours)			Hours	Theory Marks		Practical Marks		Total Marks
FB 501 FABRICATION INPLANT TRAINING -I	**L**	**T**	**P**	**H**	**TH**	**TM**	**PR**	**TW**	
					---	---	100	100	GRADE

3. COURSE OUTCOMES:

On successful completion of the course, the student will be able to:

FB501.CO1 .Understand the work culture prevalent in the industry

FB502.CO2. Imbibe the work culture and the best industry practices and inculcate the principles whilecooperating and collaborating with industry personnel

FB503.CO3. Documenting the industrial experiences and day to day functioning of the various industryfunctions & processes in the daily diary.

FB504.CO4. Implement the industrial experience for better understanding of academic learning

4. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific knowledge	Problem Analysis	Design & development of Solutions	Engineering tools, Experimentation and practice	Engineering practices for society , sustainability and Environment	Project Management	Life-long learning
CO1	2	2	1	1	1	3	2
CO2	2	2	1	1	2	3	2
CO3	1	1	1	1	1	2	2
CO4	2	2	1	1	1	2	2

Relationship : Low-1 Medium-2 High-3

	PSO1	PSO2
CO1	1	2
CO2	1	3
CO3	1	2
CO4	1	3

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN Students are required to study and have hands-on experience whereverpossible in the following areas (depending on availability):

1. Company Profile
2. Organizational Structure
3. Company Product Range
4. Manufacturing Facilities Available /Services provided
5. Plant / Facility Layout
6. Operations / Production Processes
7. Production Planning and Control
8. Detail study of Latest Equipment/ Technologies Used
9. Stores Functions
10. Material Handling Systems/ Equipments
11. Quality Management Systems / Functions
12. Maintenance and Repair Practices
13. Scrap disposal procedures being followed in the industry
14. Safety Practices / Safety Equipments
15. Utilities
16. Logistics
17. Sales and Marketing
18. Ethics, Statutory Rules and Regulations followed
19. Product Design and Development
20. Any other area specific to the Industry providing Training

6. COURSE DELIVERY:

The Course will be delivered through placement of the students in various industries

7. The Time allocation:

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

8. TERM WORK & PRACTICALS

Evaluation Scheme					
TW			**PR/OR**		
Industrial Mentor's assessment Marks	Institute Mentor's assessment Marks	Daily Dairy	Training Report Assessment	Seminar/Viva	**TOTAL Marks**
25	**25**	**50**	**50**	**50**	**GRADE**

Daily Dairy

The trainees should maintain a daily diary in the notebook provided by institution. It should contain a brief account of observations and activities performed everyday by the trainees to the

satisfaction of the Industrymentor. It should be shown to the Industry mentor for assessment and counter signature should be obtainedat least once in a week.

Assessment

The assessment of progress should be done whenever the Institute mentor visits the industry. The trainees should deliver seminar and submit an interim report at the end of 11th week of the training to the Institute mentor. The interim report shall be written by referring the daily diary, which is maintained by the trainee. Later, the Institute mentor and Industry mentor shall assess the progress of student either independently or in consultation based on the performance & qualification factors suggested below:

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	
Quality 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				

Training Report

The 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 &

SketchesGuide line 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 Equipments/machine /tools encountered: sketches/ photographs, specifications, applications.
6. Production processes employed.
7. Safety measures observed

8. Specific areas of Interest/ Assignments/ Projects undertaken.
9. Experience gained
10. List of figures/graphs.
11. List of tables.
12. Acknowledgement.

13. References

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 shall assess the seminar presentation, for maximum of 50 marks.

Note:

a. Student/s undergoing Industrial Training shall follow Rules and Regulations of the Industry.

b. Industrial Training will generally be organized and conducted in accordance with Industrial TrainingManual duly prescribed by the Board.

9. SUGGESTED SPECIFICATION TABLE WITH MARKS & HOURS

Unit No	Name of the Unit	Teaching Hours	Marks
1	**PR/OR**	**22 weeks**	**100**
2	**TW**		**100**
	Total	**22 weeks**	**GRADE**

Note:

1. Student/s undergoing Industrial Training shall follow Rules and Regulations of the Industry.

2. Industrial Training will generally be organized and conducted in accordance with Industrial TrainingManual duly prescribed by the Board.

3. For Industrial training 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'

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

5. Note for trainees:- The attendance should not be less than 75% of 22 weeks of the training period(Working days only being considered).

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

SEMESTER VITH

SEMESTER	COURSE CODE	NAME OF COURSE	TEACHING SCHEME				EXAMINATION SCHEME				Total Marks
							Theory		Practical		
			L	T	P	H	TH	TM	PR	TW	
SIXTH	AC101	Essence of Indian Knowledge and Tradition	2	0	0	2	-	-	-	-	-
	FB601	Theory of Structures	4	1	0	5	75	25	-	25	125
	CC601	Industrial Organisation & Management	3	0	0	3	75	25	-	-	100
	FB603	Erection Engineering	3	0	4	7	75	25	25	25	150
	FB 604	Quality Control & Inspection	3	0	2	5	75	25	25	25	150
	FB605	Fabrication Workshop Practice	0	0	4	4	-	-	25	50	75
		Elective-I	3	0	2	5	75	25	25	25	150
		Total	18	1	12	31	375	125	100	150	750

AUDIT COURSE

(AC 101) ESSENCE OF INDIAN KNOWLEDGE AND TRADITION

1. COURSE OBJECTIVES:

This course aims at imparting basic principles of thought process, reasoning and inferencing by human being. Sustainability is at the core of Indian Traditional Knowledge Systems connecting society and nature. Holistic life style of Yogis, science and wisdom capsules in Sanskrit literature are also important in modern society with rapid technological advancements and societal disruptions. The course thus focuses on introduction to Indian Knowledge System, Indian perspective of modern scientific world-view, basic principles of Yoga and holistic health care system.

2. TEACHING AND EXAMINATION SCHEME

Semester V									
Course code & course title	Periods/Week (in hours)			Total Credits	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
(AC101) Essence of Indian Knowledge and Tradition	L	T	P	C	TH	TM	TW	PR/OR	
	2	-	-	2	-	-	-	-	-

Course Content:

(i) वेद, (ii) उन्नवेद (आयुवेद, धनुवेद, गन्धवेद, स्थान्नत्य आदद) (iii) वेदांग (शिक्षा, कल्न, ननरुत, व्याकरण, ज्योनतष छांद), (iv) उन्नाइग (धर्म सि्र, रीरांसा, नुराण, तकमिास्र)

Basic Structure of Indian Knowledge System:

- Modern Science and Indian Knowledge System
- Yoga and Holistic Health care
- Case Studies.

S. No.	Title of Book	Author	Publication
1.	Cultural Heritage of India- Course Material	V. Sivaramakrishna	Bharatiya Vidya Bhavan, Mumbai, 5th Edition, 2014
2.	Modern Physics and Vedant	Swami Jitatmanand	Bharatiya Vidya Bhavan
3.	The wave of Life	Fritzof Capra	
4.	Tao of Physics	Fritzof Capra	
5.	Tarkasangraha of Annam Bhatta, Inernational	V N Jha	Chinmay Foundation, Velliarnad, Amaku,am
6.	Science of Consciousness Psychotherapy and Yoga Practices	RN Jha	Vidyanidhi Prakasham, Delhi, 2016

(FB 601) THEORY OF STRUCTURES

1. COURSE OBJECTIVES

The course contents have been designed to assist the students in the determination of forces acting on a structure and to assess the effects of these forces and the behavior of the structure in different conditions. Furthermore, the course contents also will develop the cognitive abilities and skills to facilitate the higher level study of design of steel structures.

2. TEACHING AND EXAMINATION SCHEME

Semester	**VI**								
Course code & course title		**Periods/Week (in hours)**			**Total Hours**	**Examination Scheme**			
						Theory Marks		**Practical Marks**		**Total Marks**
FB601 THEORY OF STRUCTURES		**L**	**T**	**P**	**H**	**TH**	**TM**	**TW**	**PR/OR**	
		4	1	0	5	75	25	25	-	125

3. COURSE OUTCOMES:

On successful completion of the course, the student will be able to:

1. State the principles of axial, bending in Columns, Beams & Frames and effect of loads in pin jointedperfect plane frames /trusses, Torsion of shafts, slope & deflections in beams.
2. Understand effect of stresses under eccentric loading, concept of Principal Stresses and behavior ofstructural members under deflections.
3. Analyses the Fixed beams. Continuous beams, Portal frames and Perfect Trusses
4. Design of shafts.

4. Mapping Course Outcomes with Program Outcomes

Relationship : Low-1 Medium-2 High-3

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific knowledge	Problem Analysis	Design & development of Solutions	Engineering tools, Experimentation and practice	Engineering practices for society , sustainability and Environment	Project Management	Life-long learning
CO 1	3	3	1	---	--	--	1
CO 2	3	3	--	1	---	---	1
CO 3	3	3	1	---	---	--	2
CO 4	3	3	3	--	--	--	2

	PSO1	PSO2
CO1	3	1
CO2	3	1
CO3	3	1
CO4	3	1

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	**Thr = Teaching hours**	**CO = Course Objectives**

Unit	**M**	**Thr**	**CO**
1 Combined Bending & Axial Loading			
1.1 Definition of eccentric load, Eccentricity, limit of eccentricity, middle third rule, middle quarter Rule, Core and Kernel of section for rectangular circular, hollow circular and hollow rectangular column.	03	03	CO1
1.2 Determination of stresses due to Combined Bending & Axial Loading in structures of for eccentric about one as well as both axes. Determination of stresses in Chimney Structures due to wind pressure.	09	09	CO1
2 Analysis of Pin Jointed Plane Frames/Trusses			
1.1 Definition of Frame / Truss, Perfect, Deficient and Reduntant Frames/Trusses. Assumptions and Nature of Forces in the member of Truss for Pin Jointed Loaded Truss	3	2	CO1
1.2 Method of Analysis – By (i)Method of Joints (ii)Methods of Sections(iii) Graphical Method To Analyze Simply supported and Cantilever perfect trusses by Method of Joints.	9	8	CO3
3 Analysis of Indeterminate Structures			
3.1 Definition of indeterminacy, external & internal indeterminacy, uses of indeterminate structures.	03	02	CO2
3.2 Definition of a fixed beam and fixed end moments, Determination of fixed end moments for the beams carrying point loads and U.D.L. on full and Part span (derivation not expected in the exams).	06	02	CO2
3.3 Definition of stiffness, relative stiffness, distribution factor, carry over factor,	03	02	CO2
3.4 to analyse fixed beams for concentrated and uniformly distributed load combination and to plot shear force and bending moment diagrams	06	08	CO2
3.5 Analysis of continuous beams with uniform sections (without sinking) and carrying point load and or U.D.L. over entire spans I (maximum four supports only), Analysis of single storeyed single horizontal span portal frame (non sway type) carrying point load or U.D.L over entire span. Construction of SFD and BMD	09	13	CO2
4 Torsion of Circular shaft			
4.1 Concept of pure torsion, assumptions in the theory of pure torsion , torsion equation, polar modulus, power transmitted by the shaft, torsional rigidity of shaft, advantages of hollow circular shafts,	03	04	CO3
4.2 Analysis of solid circular and hollow shafts in pure torsion (derivation not expected in the exams) Design of solids& Hollow circular shaft.	06	07	CO3, CO4

4.3Concept of Principal planes and Principal stresses in shaft due to torsion and bending and axial thrust.	06	04	CO3

5 Slope and Deflection in Beams			
5.1 Concept of slope and deflations, Standard expression for Slope and deflection for simply supported and cantilever beams for point load and UDL throughout the span (derivation not expected in the exams) Deflated shape of simply supported beam, cantilever beam, continuous beams and portal frame.(No numerical example for continuous beam and portal frame).	03	04	CO3
5.2 Determination of Slope and deflection for simply supported and cantilever beams for point load and UDL throughout the span	06	08	CO3
Total	**75**	**80**	-

6. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies

7. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	**Combined Bending & Axial Loading**	**12**	**12**
2	**Analysis of Pin Jointed Plane Frames**	**10**	**12**
2	**Analysis of Indeterminate Structures**	**27**	**27**
3	**Torsion of Circular shaft**	**16**	**15**
4	**Slope and Deflection in Beams**	**15**	**9**
	Total	**80**	**75**

8. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	Practical	Marks
1	Practice on solving problems on eccentrically loaded columns, Graphical Method of analysis of Simple Supported and Cantilever Trusses, Slope and deflection in beams, torsion of shaft (At least 3 problems in each Topics)	15
2	To plot shear force and bending moment diagram on half imperial size drawing sheet for fixed beams, continuous beam and a portal frame along with analytical solutions.	10
	Total	25

9. LEARNING RESOURCESText Books

S. No.	Author	Title of Books	Publishers
1	S. Ramamruthan	Strength of Materials	Dhanpat Rai & Sons , New Delhi
2	Vazirani & Ratwani	Analysis of Structures	Khanna Publishers New Delhi
3	Dr. Sandhu Singh	Strength of Materials	Khanna Publishers New Delhi
4			

5	R.S. Khurmi	Analysis of	S. Chand & Conmpany Ltd. Delhi

		Structures	
6			
7			
8	S. Ramamrnthan	Theory of Structures	Dhanpat Rai & Sons , New Delhi

S. No.	Author	Title of Books	Publishers
1	S. P. Timoshenko	Theory of Structures	Mc Graw Hill
2	R.S. Biyani	Theory of Structures	Vrinda Publication , Jalgao
3	S. S. Bhavikatti	Strength of Materials	Vikas Publishing House Pvt. Ld. Noida (UP)
4	Ferdinanand Singer	Strength of Materials	

Reference Books for further study

Internet and Web Resources

S. No.	Author	Title of Books	Publishers
1	SCIA	https://www.scia.net	

Videos and Multimedia Tutorials

S. No.	Author	Title of Books	Publishers
1	NPTEL	Civil Engineering Structural Analysis I	

(CC 601) INDUSTRIAL ORGANISATION AND MANAGEMENT

1. COURSE OBJECTIVES:

Management is the basic need of any organization. Organization consists of multiple activities which are to be systematically managed for effective output. The course covers various principles related to organization and management. The areas covered are finance, human resource, project management etc. After completion of the course, the student will be acquainted with management and other related aspects so that he/she will be able to apply this knowledge in order to achieve the organizational goals.

2. TEACHING AND EXAMINATION SCHEME

Course Code & Course Title	Periods/ Week (in hours)			Total Hours	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
CC601 INDUSTRIAL ORGANISATION AND MANAGEMENT	L	T	P	H	TH	TM	TW	PR/OR	100
	3	-	-	3	75	25	-	-	

3. COURSE OUTCOMES

On successful completion of the course, the student will be able to:

CC601.CO1: Describe types of business organizations.

CC601.CO2: Apply the principles of managing Men, Machines, and Materials in an industry.

CC601.CO3: Evaluate financial status of an industrial organization.

CC601.CO4: Develop problem solving skills in project management.

4. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO1	PSO2
CO1	2	0	0	0	0	1	0	0	2
CO2	2	1	1	1	1	2	2	0	3
CO3	3	2	1	2	3	3	2	0	3
CO4	3	3	2	2	2	3	3	2	3

Relationship: Low-1 Medium-2 High-3

5. DETAILED COURSE CONTENTS/ MICRO-LESSON PLAN

M=Marks | **Thr= Teaching hours** | **CO= Course Outcomes**			
Unit	**M**	**Thr**	**CO**
1. BUSINESS ORGANIZATION **1.1** Types of business organizations: Individual proprietorship, Partnership, Joint Stock Companies: Private Ltd and Public Ltd, Co-operative societies, Public sector **1.2** Structure of business organization: Line organization, Functional Organisation, Line and staff organization, Project organization	10	6	CO1 CO2
2. BUSINESS MANAGEMENT **2.1 :** Concept of management and administration, management as an art and science, evolution and growth of scientific management- contribution of F.W Taylor. **2.2** Basic functions of management: planning, organizing, staffing, directing, controlling. Other functions: forecasting, coordinating and decision- making. **2.3** Functions in Industry: Basics of Procuring, store- keeping, material handling, production, packing and forwarding, marketing and sales, supervision, research and development. **2.4** Supervisory skills required in industry	16	9	CO1 CO2 CO3
3. BASICS OF FINANCE **3.1** Sources of finance **3.2** Cost Concepts: Necessity of costing, elements of cost: material, Labour and expense; prime cost, overhead cost, total cost, And break- even analysis. **3.3** Materials management: Inventory control-standard order, reserve stock, reorder point, lead time. Economic order quantity, ABC Analysis. Introduction to Just in time (JIT) system **3.4** Depreciation: Definition and causes. Methods of calculating depreciation charges: Straight Line Method, Diminishing Balance Method, Sinking Fund method .(Simple Numericals) **3.5** Obsolescence- definitions and reasons. **3.6** Introduction to GST.	18	13	CO1 CO2 CO3 CO4

4.HUMAN RESOURCE MANAGEMENT **4.1** Functions of Personnel Department**:** Human resource planning, selection and recruitment, training, promotion and transfer, welfare of employees. **4.2** Industrial Relations**:** Employer-employee relations, trade union, settlement of disputes of employees, collective bargaining, conciliation, arbitration, grievance handling mechanism. **4.3** Wages and Incentives**:** Factors influencing wages, types of wage plans – time rate and piece rate, Incentive – objectives and types, individual and group incentive plan, characteristics of a good wage or incentive plan, difference between incentive and wage. **4.4** Industrial Acts: Introduction to the following Industrial Acts: Industrial Disputes Act 1947/1956;	21	14	CO1 CO2 CO3 CO4

The Indian Factories Act 1948 The Workmen's Compensation Act 1923			
5.PROJECT MANAGEMENT **5.1** Introduction to Project Management **5.2** Network Analysis (Introduction to basic concepts with simple Numericals) CPM- Critical Path Method: Definition, network diagrams, critical path, advantages PERT- Programme Evaluation and Review Technique: Definition, network diagrams, advantages. Comparison of PERT and CPM.	10	6	CO1 CO2 CO3 CO4
Total	**75**	**48**	

6. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies

7. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	Business Organization	6	10
2	Business Management	9	16
3	Basics of Finance	13	18
4	Human Resource Management	14	21
5	Project Management	6	10
	Total	**48**	**75**

8. LEARNING RESOURCESText

Books

S. No	Author	Title of Book	Publisher
1	O.P. Khanna	Industrial Engineering and Management	Dhanpat Rai Publications
2	T. R. Banga ,S.C. Sharma	Industrial Organisation and Engineering Economics	Khanna Publishers
3	Awate, Chunawala, Patel, Bhandarkar, Sriniwasan	Industrial Organisation and Management	Vrinda Publication
4	Martand Telsang	Industrial Engineering and Production Management	S.Chand & Company Ltd

(FB 603) ERECTION ENGINEERING

1. COURSE OBJECTIVES

A technician engaged in structural erection and erection of machinery is required to possess a good knowledge of erection equipment and tools. He should have the required skill in theselection of methods. He is also responsible for directing the erection work and preventing accidents. The course on erection engineering 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. For practical experience, exposure to both mechanical and civil engineering projects work is aimed in this course.

2. TEACHING AND EXAMINATION SCHEME

Semester	**VI**								
Course code & course title		**Periods/Week (in hours)**			**Total Hours**	**Examination Scheme**			
						Theory Marks		**Practical Marks**	**Total Marks**
FB603 ERECTION ENGINEERING		**L**	**T**	**P**	**H**	**TH**	**TM**	**TW**	**PR/OR**
		3	0	4	7	75	25	25	25	150

3. COURSE OUTCOMES:

On successful completion of the course, the student will be able to:
FB603.CO1. Gain additional knowledge to give a cutting edge as an expert in erection engineeringFB603.CO2. Give better understanding of erection material, tools and tackles.
FB603.CO3. Create awareness and understanding of industrial and project site safety.FB603.CO4. Select safe practices in use of hoisting equipment, cranes etc.

4. Mapping Course Outcomes with Program Outcomes

Relationship : Low-1 Medium-2 High-3

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific knowledge	Problem Analysis	Design & development of Solutions	Engineering tools, Experimentation and practice	Engineering practices for society , sustainability and Environment	Project Management	Life-long learning
CO 1	3	2	2	3	2	3	2
CO 2	3	2	2	3	2	2	2
CO 3	3	3	3	2	2	3	2
CO 4	3	2	3	3	2	3	2

	PSO1	PSO2
CO1	3	3
CO2	3	3
CO3	3	3
CO4	3	3

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	Thr = Teaching hours	CO = Course Objectives			
Unit			**M**	**Thr**	**CO**
1 ERECTION MATERIALS AND TOOLS					
1.1. Profile of an Erection Engineer 1.2. Natural Fibre Ropes – Characteristics and Features a. Manila rope b. Sisal rope c. Hemp rope d. Coir rope. 1.3. Construction of Natural fibre ropes 1.4. Directions of lay, right and left hand lay 1.5. Hard laid and soft laid ropes 1.6. Plain lay rope (three stranded rope) Shrewd lay rope (four stranded rope) 1.7. Cable lay rope 1.8. Whipping and Seizing of Ropes 1.9. Precautions in handling and storing of natural fibre ropes 1.10. Synthetic Fibre Ropes - Characteristics and Uses, a. Polyamides (nylon) rope b. Polyesters (Terylene) rope c. Polypropylene rope d. Polyethylene rope 1.11. Construction of Synthetic Fibre Ropes 1.12. Plain laid or house laid construction 1.13. Braided rope construction 1.14. Plaited rope construction 1.15. Parafil construction 1.16. Precautions in handling and storing synthetic fibre ropes 1.17. Inspection of synthetic fibre ropes 1.18. Steel Wire Ropes (SWR) 1.19. Construction and their application 1.20. Specification of wire ropes 1.21. Kinking, cause, effect and method of possible removal in case of ropes of small diameters. 1.22. Precaution in handling and storage of wire ropes 1.23. Lubrication of wire ropes 1.24. Inspection of steel wire ropes 1.25. Requirements of selection of SWR 1.26. Wire rope attachment 1.27. Shackles, thimbles, hooks, Cross by clips 1.28. Aluminium sleeve attachment 1.29. Wedge sockets			15	10	CO1, CO2

M = Marks	Thr = Teaching hours	CO = Course Objectives

Unit	M	Thr	CO
2 CRANES, HOISTING TOOLS & EQUIPMENTS			
2.1 Basic motions of a Crane: Slewing, luffing, hoisting. 2.2 Type of Cranes: a. Electric Overhead Crane b. Mechanical Crawler crane c. Locomotive crane d. Hydraulic crane e. Hammer head crane f. Wall Crane g. Jib Crane h. Gantry Crane i. Tower Crane 2.3 Selection of Crane according to application 2.4 Derrick: a. Guyed, b. A-Frame, c. Breast 2.5 Gin Pole, Shear leg, Outreach. 2.6 Knots, bends, hitches & splices 2.7 Hoisting Chain - Inspection 2.8 Slings - Description, merits and demerits a. Manila rope sling b. Steel chain slings c. Wire rope slings 2.9 Types of slings a. Endless sling or gourmet b. Choker sling, double choker sling, basket sling c. Double basket sling, bridle sling, turnbuckle sling. 2.10 Connecting tools a. Connecting bar, b. Maul, c. Bull pin, d. fork wrench, e. drift pin	1115 15	8 8	**CO1, CC OO2** **CO1 , CO2**

2.11 Chain hoists Description of operation and uses of the following hoists: a. Pull lift hoist b. Differential hoist c. Screw geared hoist d. Spur geared hoist			

Unit			
3 HANDLING OF LOADS, TOOLS USED			
3.1 Handling of loads on slings 3.2 Consideration for correct handling 3.3 Estimation of Center Of Gravity 3.4 Hook position 3.5 Adjusting sling lengths between hook and lifting lugs 3.6 Use of pads at sharp edges while placing Slings 3.7 Use of spreader bar 3.8 Precautions while handling loads on slings 3.9 Jacks: Types, handling loads, inspection 3.10 Rollers: Applications 3.11 Skids: Applications	15	10	**CO2, CO3, CO4**
4 ERECTION PROCEDURES, TECHNIQUES AND INSPECTIONS			
4.1 Introduction 4.2 Preparatory work and important considerations 4.3 Precautions at erection site 4.4 Methods of erection, leveling and alignment 4.5 Allowable tolerances for plumbing 4.6 Erection of tackle and false work 4.7 Erection by raising of guy derrick 4.8 Erection using a mobile crane 4.9 Method of erection of a. Shed type structure b. Multi-storey building 4.10 Protection of structure against corrosion 4.11 Guidelines to maintain quality in erection work 4.12 Common defects 4.13 Inspection and rectification	15	10	**CO3, CO4**

M = Marks	Thr = Teaching hours	CO = Course Objectives			
Unit			**M**	**Thr**	**CO**
5 ACCIDENT PREVENTION AND SAFETY					
5.1 Definition of accident prevention 5.2 Personal injury accidents and property damage accidents. 5.3 Causes of accidents 5.4 Human factors for causing accidents 5.5 Safety rules while using: a. Cranes b. Winches c. Pulley Block d. Lifting appliances e. Slings f. Scaffolding 5.6 Failure of machinery and equipment 5.7 Benefits of accident prevention 5.8 Accident prevention measures 5.9 Good housekeeping and layout 5.10 Proper illumination and safe working conditions 5.11 Care for environmental factors 5.12 Care in handing loads by lifting machines 5.13 Human factors 5.14 Use of protective equipment 5.15 Hoist signals 5.16 Objectives for devising hoist signals 5.17 Hoist Signals for crane operation a. Hoist Load b. Lower Load c. Back trolley d. Travel crane bridge e. Boom up f. Boom down g. Stop h. Emergency stop i. Slew boom 5.18 Whistle signals & electronic devices for Derrick Operation			15	10	**CO3, CO4**
		Total	**75**	**48**	

6. COURSE DELIVERY:

The course will be delivered through lectures, class room interactions, practical exercises conducted inerection yard

7. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	Erection materials and tools	10	15
2	Cranes, hoisting tools & equipment	8	15
3	Handling of loads, tools used	10	15
4	Erection procedures, techniques and inspections	10	15
5	Accident prevention and safety	10	15
	Total	48	75

8. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	Practical	Marks
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	Practice on hoisting signals	
7	Visit to big project site	
	Total	25
No	**Class room Assignments**	**Marks**
1	Teacher to decide. Test marks can be distributed as 20+5 = 25, where 5 marks are given for classroom/ home assignments.	

9. LEARNING RESOURCESText

Books

S. No.	Author	Title of Books	Publishers
1	S.K. Saxena, R. B. Asthana	Structural Steel Fabrication and Erection	Somaiya Pub. Pvt. Ltd.
2	W.E. Rossnagel	Hand book of Rigging- For construction & industrial operations	Mc Graw-Hill Book Co.
3	D.E. Dickie	Crane Handbook	Butterworth & Co. Ltd.

Reference Books for further study

S. No.	Author	Title of Books	Publishers
1	Havers and Stubbs	Handbook of Heavy Construction	Mc Graw-Hill Book Co
2	Shivagunde, Asthana	Structural Steel Drafting and Detailing	Somaiya Pub. Pvt. Ltd
3	F. S. Merit	Building Construction Handbook	Mc Graw-Hill Book Co

Indian and International codes needed

S. No.	Author	Title of Books	Publishers
1	AS 3828:1998	Guidelines for the erection of building steelwork	Standards Australia
2	AS 4100:1998	Steel structures.	Standards Australia
3	IS : 7205- l974 (Reaffirmed 1995)	Indian Standard SAFETY CODE FOR ERECTION OF STRUCTURAL STEELWORK	Bureau of Indian Standard, New Delhi
4	IS : 3696 (Part I) - 1987	Indian Standard SAFETY CODE FOR SCAFFOLDS AND LADDERS PART I SCAFFOLDS (First Revision)	Bureau of Indian Standard, New Delhi

Internet and Web Resources

S. No.	Author	Title of Books	Publishers
1	-	Industry standard: Safe erection of structural steel for buildings Edition No. 1, May 2009	WorkSafe Victoria
2	-	Basic Scaffolding Erection Procedure	You Tube: RAEI's Entertainment and Knowledge Channel

Videos and Multimedia Tutorials

S. No.	Author	Title of Books	Publishers
1	Costas Philippou	Mobile crane operator training	You tube
2	Subrata Kabiraj	Mechanical erection work in India	You tube

(FB 604) QUALITY CONTROL & INSPECTION

1. COURSE OBJECTIVES

A technician working in quality control and inspection department must develop quality consciousness in performing his duties. He must be familiar with processes and methods which build quality into his product or service. This course is designed to develop these abilities and skills.

2. TEACHING AND EXAMINATION SCHEME

Semester VI									
Course code & course title	Periods/Week (in hours)			Total Hours	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
FB604 QUALITY CONTROL & INSPECTION	L	T	P	H	TH	TM	TW	PR/OR	
	3	0	2	5	75	25	25	25	150

3. COURSE OUTCOMES:

On successful completion of the course, the student will be able to:

1. Acquire the knowledge of quality, quality control, inspection and testing.
2. Use various testing equipment.
3. Select appropriate testing method for required quality parameters of welded components.
4. Conduct quality checks for welded component.

4. Mapping Course Outcomes with Program Outcomes

Relationship : Low-1 Medium-2 High-3

	PO 1 Basic & Discipline Specific knowledge	PO 2 Problem Analysis	PO 3 Design & development of Solutions	PO 4 Engineering tools, Experimentation and practice	PO 5 Engineering practices for society , sustainability and Environment	PO 6 Project Management	PO 7 Life-long learning
CO 1	3	1	2	1	1	3	3
CO 2	3	3	1	3	1	3	3
CO 3	3	3	2	2	1	3	3
CO 4	3	3	3	3	3	3	3

	PSO1	PSO2
CO1	3	3
CO2	3	3
CO3	3	3
CO4	3	2

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	**Thr = Teaching hours**	**CO = Course Objectives**			
Unit			**M**	**Thr**	**CO**
1 BASIC CONCEPTS OF QUALITY & QUALITY CONTROL					
1.1 Basic concepts of Quality: Definition of quality as fitness for use, Quality characteristic, Parameters of fitness for use: (a) quality of design (b) quality of conformance (c) abilities – availability, reliability & maintainability (d) field service, Factors affecting quality of a product.			6	3	CO1
1.2 Basic concepts of Quality Control: Definition of Control, Regulatory process of control, Definition of Quality control, Basic objectives, Advantages of quality control, Role of technician in promoting quality mindedness among workers and operators.			3	3	CO1
1.3 Broad areas of applications of quality control: incoming materials control, process control, product control.			3	2	CO1
1.4 Approach to solution of quality problems (Briefly): Engineering, Statistical and Management.					CO1
1.5 Quality value, Quality cost, Balance between quality cost and value			3	2	CO1
1.6 Categories of quality cost: prevention, appraisal, internal failure, external failure.					CO1
			15	**10**	
2 QUALITY ASSURANCE					
2.1 Definition			9	6	CO1
2.2 Tools of Quality Assurance (in brief), TQM, ISO 9000, 5S, Quality Circle, Zero defect, 6 sigma, Kaizen					CO1, CO2, CO3, CO4
			9	**6**	
3 INSPECTION					
3.1 Definition and Meaning			3	1	CO1
3.2 Difference between inspection and quality control					CO1
3.3 Aims of inspection			3	1	CO1
3.4 Classifications of inspection:- (i) Based on work performance (ii) Based on location					CO1
3.5 Duties of inspector			6	5	CO1
3.6 Inspection planning					CO1
3.7 Tools of inspection				1	CO1
			12	**8**	
4 DESTRUCTIVE TESTING					
4.1 Tensile Test: Preparation of specimen, Test procedure			6	2	CO1, CO2, CO3, CO4
4.2 Bend test: Purpose, Free bend test, Guided bend test, Transverse bend test, Longitudinal bend test, Side bend test.				2	CO1, CO2, CO3, CO4

M = Marks	**Thr = Teaching hours**	**CO = Course Objectives**			
Unit			**M**	**Thr**	**CO**
4.3 Impact test: Principle, Types of tests: Charpy test & Izod test, Test procedure.			3	2	CO1, CO2, CO3, CO4
4.4 Etch Test: Concept, Etching reagents, Preparation of test specimen, Types of tests: Macro & Micro, Test Procedure.			6	1	CO1, CO2, CO3, CO4
4.5 Nick Break Test: Purpose, Preparation of specimen, Test procedure				1	CO1, CO2, CO3, CO4
4.6 Hardness test: Purpose, Types of tests: Brinell test, Rockwell test & Vikers Hardness test, Test Procedure.				2	CO1, CO2, CO3, CO4
			15	**10**	
5 NON DESTRUCTIVE TESTING					
5.1 Visual Inspection			3	2	CO1, CO2, CO3, CO4
5.2 Acoustic Test / Sound Test					CO1, CO2, CO3, CO4
5.3 Leak Test: Concept, Purpose, Types, Procedure, Water soluble paper test with aluminium foil.			3		CO1, CO2, CO3, CO4
5.4 Magnetic Particle Testing: Principle, Procedure, Magnetising the specimen, Applying magnetic particles, Locating the defects, Advantages, Disadvantages			6	3	CO1, CO2, CO3, CO4
5.5 Dye Penetrant Inspection: Principle, Procedure, Advantages, Disadvantages, Applications, Fluorescent process			6	1	CO1, CO2, CO3, CO4
5.6 Ultrasonic Inspections: Principle, Procedure, Advantages, Limitations, Applications				3	CO1, CO2, CO3, CO4
5.7 Eddy Current Testing: Principle, Procedure, Advantages, Limitations, Applications.					CO1, CO2, CO3, CO4
5.8 Radiographic Testing: principle of X-rays, X-ray radiography, Advantages, Disadvantages, Applications, principle of Gamma-rays, Gamma-ray radiography, Advantages, Disadvantages, Applications, Penetrameters.			6	5	CO1, CO2, CO3, CO4
			24	**14**	

Total	**75**	**48**	**-**

6. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies

7. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	BASIC CONCEPTS OF QUALITY& QUALITY CONTROL	10	15
2	QUALITY ASSURANCE	6	9
3	INSPECTION	8	12
4	DESTRUCTIVE TESTING	10	15
5	NON DESTRUCTIVE TESTING	14	24
	Total	48	75

8. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	Practical	Marks
1	Study of different defects in welded joints.	5
2	Visual Inspection & Sound Test	5
3	Dye penetrant test.	
4	Fluorescent penetrant test	
5	Magnetic particle test	5
6	Tensile tests on welded specimens (Welded by MMAW, GMAW or Gas Welding)	5
7	Bend tests on welded specimen	5
8	Impact tests on welded specimen	
	Total	25

9. LEARNING RESOURCESText

Books

S. No.	Author	Title of Books	Publishers
1	M. S. Mahajan & B. S. Chaudhari	Metrology & Quality Control	Vrinda Publications
2	Dr. O. P. Khanna	A text-book of Welding Technology	Dhanpat Rai & Sons, Delhi
3	R. K. Jain	Engineering Metrology	Khanna Publishers
4	M. V. V. Raman,	Inspection & Quality Control	National Productivity Council

Reference Books for further study

S. No.	Author	Title of Books	Publishers
1	J. M. Juran & F. M. Gryna	Quality Planning & Analysis	TATA McGraw-Hill Pub.
2	-----	Metals Handbook ASM, Vol 6	-----

(FB 605) FABRICATION WORKSHOP PRACTICE

1. COURSE OBJECTIVES

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 works in the form of minor project. 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

2. TEACHING AND EXAMINATION SCHEME

Semester	**VI**								
Course code & course title		**Periods/Week (in hours)**			**Total Hours**	**Examination Scheme**			
						Theory Marks		**Practical Marks**		**Total Marks**
FB 605 FABRICATION WORKSHOP PRACTICE		**L**	**T**	**P**	**H**	**TH**	**TM**	**TW**	**PR/OR**	
		0	0	4	4	-	-	50	25	75

3. COURSE OUTCOMES:

On successful completion of the course, the student will be able to:

FB605.CO1. Select appropriate tools and machinery for fabrication activities.

FB605.CO2. Apply the knowledge of the subjects of welding and engineering drawing, and basicengineering practice learnt earlier.

FB605.CO3. Outline the activities of doing mini-projects. FB605.CO4. Develop team spirit for executing mini-projects

4. Mapping Course Outcomes with Program Outcomes

Relationship : Low-1 Medium-2 High-3

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific knowledge	Problem Analysis	Design & development of Solutions	Engineering tools, Experimentation and practice	Engineering practices for society , sustainability and Environment	Project Management	Life-long learning
CO 1	3	1	2	2	2	1	2
CO 2	2	2	2	2	2	1	2
CO 3	2	1	1	2	2	1	2
CO 4	3	2	2	2	2	3	2

	PSO1	PSO2
CO1	2	1
CO2	3	2
CO3	3	1
CO4	2	2

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	**Thr = Teaching hours**	**CO = Course Objectives**			
Unit			**M**	**Pr**	**CO**
1 Drilling and Riveting			**10**	**-**	CO1, CO2
1.1 Finding the thickness of plate using Vernier Calipers. Accordingly, calculating the rivet and the corresponding hole diameters.					
1.2. Calculation and marking of various pitches, edge and end distances for a riveted lap joint					
1.3 Practicing drilling of holes in a structure and fixing a blind and solid rivet					
2 Bending of Bars			10	-	CO1, CO2
2.1 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					
2.2 Bending round bars of size 10mm dia and square bars of size 10mm to form different shapes like small rings, S- shape, - shape (at least two different shapes per student) to the required dimensions					
3 Rolling of plates			10	-	CO1, CO2
3.1 Rolling a plate to form a cylinder on 3- roll plate bending machine.					
4 Pipe bends and intersection templates			10	-	CO1, CO2,
4.1 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.					
5 Fabrication Jobs			10	-	CO3, CO4
5.1 Marking an angle of size 25mm x 25mm x 30mm and cut and bend the corners to form an angle frame to the required dimensions.					
5.2 Fabricating trapezoidal dust bins from I mm sheet metal and joints made of rivets					
5.3 Aluminum structure like a window frame with aluminum extrusions with the help of self-tapping screws					
5.4 Twisting a 10mm square bar with a bar twisting tool and vice					
5.5 Bending manually an angle to form a ring with the flange leg outside and/or inside					
Total			**50**		

6. COURSE DELIVERY:

The Course will be delivered through practical sessions in workshop.

7. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	Practical	Marks
1.	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 (at least two different shapes per student) to the required dimensions 4. Marking an angle of size 25mm x 25mm x 30mm 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, 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 inside. 8. Fabricating Aluminium structure like a window frame with Aluminium extrusions with this of self-tapping screws	25
2	**Group Exercises:**	25
	1. Fabrication of a small table of angles and flats	
	2. Fabricating trapezoidal dust bins from 1 mm sheet metal and joints made of rivets.	
	3. Twisting a 10mm square bar with a bar twisting tool and vice.	
	4. Fabricating a structure like grills of different design of interior members.	
	5. Repair or Maintenance of any steel structure in the institution premises.	
	6. Fabrication of a stool of angles and bars.	
	Total	50(TW)

8. LEARNING RESOURCESText Books

S. No.	Author	Title of Books	Publishers
1	R. L. Chary Nachinolkar	Fabrication Workshop Practice Workbook	Raghuvir L. Chary Nachinolkar Government Polytechnic Panaji
2	A. Dickason	Sheet Metal Drawing and Pattern Development	Pitman Publishing Ltd.
3	W. A. Atkins	Practical Sheet and Plate Metal Work	Sir Isaac Pitman and sons

S. No.	Author	Title of Books	Publishers
4	Smith, F. J. , M. Longman	Basic Fabrication and Welding Engineer	
5	Cooper K. J. Greenwood	Technician Fabrication and Welding	(Cassel Series)
	K. P. Roy & S. K. Hajra Choudhury	Elements of Mechanical Engg	Media Promoters & Pub.

Internet and Web Resources

S. No.	Author	Title of Books	Publishers
1	Mudassir Iqbal	Windows Grill designs	Pinterest.com
2	JJ Technical Solutions	Welding, Riveting	www.MechieProject.com Slideshare.com
3	Roundo	3 roll plate bending machine	www.roundo.com
4	www.coletuve.com	Angle and shape bending machine	www.coletuve.com

Videos and Multimedia Tutorials

S. No.	Author	Title of Books	Publishers
1	Technical Piping	How to fabricate elbow (miter bend) from pipe?	Technical Piping Youtube
2	metalcraftuk	XL Twister, the Metal Twisting Tool from Metalcraft	metalcraftuk Youtube
3	Ben Brandt	Making a welded & bolted steel table frame	Ben Brandt Youtube
4	-	Basic Twist	Youtube

CC503 RENEWABLE ENERGY SYSTEMS AND ENERGY MANAGEMENT

1. COURSE OBJECTIVES:

To compare the different conventional energy sources with renewable energy sources. This course will also provide valuable insight on different energy conservation devices and its applications in the real world. It will also help to conduct energy audits using energy management techniques for energy conservation.

2. TEACHING AND EXAMINATION SCHEME

Semester									
Course code & course title	Periods/Week (in hours)			Total Credits	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
	L	T	P	C	TH	TM	TW	PR/OR	
CC 503 Renewable Energy Systems And Energy Management	3	-	2	5	75	25	25	25	150

3. COURSE OUTCOMES:

On successful completion of the course, the student will be able to:
CO1: Understand the various renewable energy sources and concepts of Energy management. CO2: Describe the characteristics of various renewable energy sources and types of EnergyAudits.
CO3: Design elementary Solar and wind energy systems
CO4: Apply the knowledge of energy conservation and energy management techniques to conduct energy audits.

4. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO1	PSO2
CO1	2	0	0	0	2	0	2	1	1
CO2	2	1	2	0	2	2	2	2	2
CO3	2	2	2	2	2	1	2	2	3
CO4	2	2	2	2	2	2	2	2	3

Relationship: Low-1 Medium-2 High-3

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	Thr = Teaching hours				
Unit			**M**	**Thr**	**CO**
Unit 1 INTRODUCTION TO RENEWABLE ENERGY SOURCES			**10**	**06**	
1.1 Energy Scenario in India					
1.2 Need of Renewable energy sources.					**CO1**
1.3 Types of Renewable energy sources - Basic concepts of Solar energy, Wind Energy, Tidal energy, Biomass Energy, Fuel Cell					
Unit 2 SOLAR ENERGY SYSTEMS			**16**	**10**	
Solar Energy					
2.1 Principle of conversion of solar energy into heat and electricity					
2.2 Solar Radiation: Solar Radiations at earth's surface					
2.3 Solar Radiation Geometry: Declination angle, hour angle, altitude angle, incident angle, zenith angle, solar azimuth angle					**CO1 CO2 CO3**
2.4 Characteristics of PV cell and concept of MPPT					
2.5 Construction and working of typical flat plate collector and solar concentrating collectors and their applications, advantages and limitations					
2.6 Space heating and cooling.					
2.7 Solar distillation, Solar cooking and furnace.					
Unit 3 WIND ENERGY SYSTEMS			**16**	**10**	
3.1 Basic Principle of wind energy conversion.					
3.2 Advantages and limitations of wind energy conversion.					
3.3 Classification of wind mills					**CO1 CO2 CO3**
3.4 Construction and working of horizontal and vertical axis wind mills, their comparison					
3.5 Main considerations in selecting a site for wind mills.					
3.6 Wind turbine Efficiency, Wind turbine control parameters- Yaw angle, Pitch angle, hub height, Solidity					
Unit 4 APPLICATIONS OF SOLAR AND WIND ENERGY SYSTEMS			**18**	**12**	
4.1 PV system for street lights					
4.2 Design of PV system for domestic load.					**CO2 CO3**
4.3 PV water pumping system					
4.4Design of household thermal heating system					
4.5Design of micro wind turbine for domestic load.					
Unit 5 ENERGY MANAGEMENT			**15**	**10**	
5.1 Energy scenario in various sectors and Indian economy					
5.2 Need and importance of energy conservation and management					
5.3 Principles of energy conservation.					**CO4**
5.4 Concept of Energy audit					
5.5 Types of Energy Audit					
5.6 Energy Conservation – Case study of Domestic system					
5.7Energy Conservation – Case study of Industrial system					
Total			**75**	**48**	

6. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies.

7. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	Introduction To Energy Sources	06	10
2	Solar Energy Systems	10	16
3	Wind Energy Systems	10	16
4	Applications of Solar and Wind energy systems	12	18
5	Energy Management	10	15
	Total	48	75

8. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	Practical	Marks
1.	Collect information about Indian energy market and prepare a report.	
2.	Study the construction and working of photo voltaic cell.	
3.	Study the construction, working of a solar cooker.	
4.	V-I, P-V Characteristics of Photovoltaic panel	
5.	Case Study on a nearest wind farm.	
6.	Visit to plant of solar heating system for hotel/hostel/railway station etc. and prepare a report.	
7.	Perform energy audit for workshop/Office/Home/SSI unit.	
8.	Study of various waste heat recovery devices.	
	Total	25

9. LEARNING RESOURCESText

Books

S. No.	Author	Title of Books	Publishers
1	DrB.H.Khan	Non-conventional	Tata McGraw Hill
2	S. P. Sukhatme	Energy Resources	Tata McGraw Hill
3	Arrora	Solar energy	Dhanpat Rai & co.
4	Domkundwar	Power plant engineering	Wiley Press
5	Gilbert M Masters	Renewable and Efficient Electric Power Systems	Wiley Interscience, New Jersey, 2004
6	Chetan Singh Solanki	Solar Photovoltaics; Fundamentals, Technologies and applications	PHI

(FB 616) REPAIR AND MAINTENANCE WELDING

1. COURSE OBJECTIVES

This course aims to equip the Fabrication Technician to us the wide knowledge he possess of welding process, in repair and maintenance. In this important area, parts which re put out of service, re 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

Semester	**VI**								
Course code & course title		**Periods/Week (in hours)**			**Total Hours**	**Examination Scheme**			
						Theory Marks		**Practical Marks**		**Total Marks**
FE616 REPAIR AND MAINTENANCE WELDING		**L**	**T**	**P**	**H**	**TH**	**TM**	**TW**	**PR/OR**	
		3	0	2	5	75	25	25	25	150

3.COURSE OUTCOMES:

On successful completion of the course, the student will be able to:

FE616.CO1.Understand the importance and need of repair and maintenance welding
FE616.CO2.Select and Apply appropriate type of welding process to suit a specific application FE616.CO3Analyse various aspects of welding process and make necessary adjustments to the process
to minimize adverse effects of various factors
FE616.CO4 Perform repair and maintenance welding under safe working conditions

4. Mapping Course Outcomes with Program Outcomes

Relationship : Low-1 Medium-2 High-3

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific knowledge	Problem Analysis	Design & development of Solutions	Engineering tools, Experimentation and practice	Engineering practices for society , sustainability and Environment	Project Management	Life-long learning
CO 1	3	1	1	1	1	1	1
CO 2	3	3	2	3	1	1	1
CO 3	3	3	2	2	1	1	1
CO 4	3	1	3	3	1	1	1

	PSO1	PSO2
CO1	3	3
CO2	3	3
CO3	3	3
CO4	3	3

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	**Thr = Teaching hours**	**CO = Course Objectives**		
Unit			**M**	**Thr**	**CO**
1 INTRODUCTION TO REPAIR AND MAINTENANCE WELDING					
1.1 Maintenance and repairs situations, Maintenance and repair welding, Economics of repair			6	4	CO1
2 APPROACH TO MAINTENANCE AND REPAIR WELDING					
2.1 Planning, Planning checklist			4	1	CO1
2.2 A Welding Repair Decision Model			12	8	CO1 CO2
3 APPLICATIONS OF REPAIR WELDING					
3.1 Case studies:					
a) Repairing cold storage tank leaks, Repair welding of a pressure vessel			6	3	CO1 CO2
b) Repair of fertilizer processing equipment, Repair of casting and forging			6	3	CO1 CO2
c) Repair of an engine crankshaft, Repair welding of fabricated structures			6	3	CO1 CO2
4 HARDFACING					
4.1 Introduction. Metallurgy of hard facing deposits			4	2	CO1 CO2
4.2 Types of wear. Importance of buffer layers. Hard facing alloys			4	3	CO1 CO2
4.3 Inspection and Testing. Selection of Welding process			4	2	CO1 CO2
4.4 Facing Process: Hardfacing by a)Shielded metal-arc welding b)Submerged arc welding c)Open-arc welding, d)Gas metal arc welding e)Gas tungsten arc welding f)Plasma arc welding g)Oxy-acetylene welding			9	8	CO1 CO2 CO3
4.5 Applications of hard facing: a)Oil well drilling tools, earth moving and agricultural applications b)mining and quarrying c)materials handling tools and mills equipment d)hand facing and weld repair of metal working tools			6	5	CO1 CO2 CO3 CO4
5 WELDING OF PLASTICS					
5.1 Principle of Welding plastics, Commonly welded plastics, Surface preparation			4	3	CO1
5.2 Plastic welding process: heated tool welding, hot gas welding, high frequency welding, ultrasonic welding and friction welding. Inspection and Testing			4	3	CO2 CO3 CO4
Total			**75**	**48**	**-**

6. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies

7. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	INTRODUCTION TO REPAIR AND MAINTENANCE WELDING	4	6
2	APPROACH TO MAINTENANCE AND REPAIR WELDING	9	16
3	APPLICATIONS OF REPAIR WELDING	9	18
4	HARDFACING	20	27
5	WELDING OF PLASTICS	6	8
	Total	48	75

8. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	Practical	Marks
1.	Practical Title	
1	Prepare and test the hardness of the hard facing deposit layerwise (3 layers),to illustrate the effect of dilution	5
2	Prepare sample of hard facing manganese steel and illustrate work hardening	5
3	Hard facing of shovel teeth, with buffer layer of low hydrogen electrodes followed by chrome- carbide hard faced layer (3 nos)	5
4	Three field visit to a mining repair workshop/ Engg. Workshop.	5
5	Repair of cast iron block.	5
	Total	25

9. LEARNING RESOURCESText

Books

S. No.	Author	Title of Books	Publishers
1	S.V. Nadkarni	Modern Arc Welding Technology	Advani-oerlikon Ltd
2	Dr. O.P. Khanna	A text book on Welding Technology	Dhanpat Rai & Sons Publications.

Reference Books for further study

S. No.	Author	Title of Books	Publishers
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	-----

(MC 626) SAFETY ENGINEERING

1. COURSE OBJECTIVES:

With rapid advances in industrial processes, new types of risks and hazards are being increasingly introduced. Safety of life and assets has always been a top priority in any industry. Keeping this in mind, this course is designed to acquaint the students with safety norms & principles practiced in industries**.**

2. TEACHING AND EXAMINATION SCHEME

Semester	**VI**								
Course code & course title		**Periods/Week (in hours)**			**Total Hours**	**Examination Scheme**			
						Theory Marks		**Practical Marks**	**Total Marks**
(MC626) (SAFETY ENGINEERING)		**L**	**T**	**P**	**H**	**TH**	**TM**	**TW**	**PR/OR**
		3	**-**	**2**	**5**	**75**	**25**	**25**	**25**	**150**

3. COURSE OUTCOMES:

On successful completion of the course the students will able to: **MC626.CO1:** Implement various safety practices in working environment. **MC626.CO2:** Identify the causes of accident in the workplace.

MC626.CO3: Analyze the hazards at work environment

MC626.CO4: Select appropriate personal protective equipment.

4. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO1	PSO2
CO1	3	1	1	1	3	3	2	1	2
CO2	3	3	2	2	2	2	2	2	3
CO3	3	3	2	2	2	2	2	2	2
CO4	3	3	3	2	3	2	2	2	3

Relationship : Low-1 Medium-2 High-3

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	**Thr = Teaching hours**	**CO = Course Outcomes**			
Unit			**M**	**Thr**	**CO**
1 INDUSTRIAL SAFETY AND FACTORIES ACT					
1.1 Introduction-Safety -Goals of safety engineering.					
1.2 Need for safety. Safety and productivity.					
1.3 Safety organization- objectives, types, functions,					
1.4 Role of management, supervisors, workmen, unions, government and voluntary agencies in safety, 1.5 Safety policy, 1.6 Safety Officer-responsibilities& authority. 1.7 Safety committee-need, types & advantages. 1.8 General factories act related to safety of employees and machineries 1.9 Introduction to National Institute for Occupational Safety and Health (NIOSH), Environmental Protection Agency (EPA) & Occupational Safety and Health Administration (OSHA) 1.10. Introduction to ISO Standards for Safety & Environment (ISO 45001,ISO14001)			11	8	CO1 CO2
2 ACCIDENT AND INSURANCE					
2.1 Definition of accidents, Injury, 2.2 Causes of accidents and factors affecting it, Unsafe act, Unsafe Condition, 2.3 Classification of accidents, 2.4 Accident prevention method-Engineering, Education and Enforcement. 2.5 Accident report form; 2.6 Benefits of Accident report forms; 2.7 Cost of accidents 2.8 Accident investigation –Why? When? Where? Who? & How? 2.9 Case study on accidents investigation, Job safety analysis (JSA) 5 sigma 2.10 Introduction to Insurance, Types and comparison.			20	10	CO1 CO2 CO3
3. SAFETY EDUCATION & HOUSEKEEPING					

3.1 Safety Education & Training -Importance, 3.2 Various training methods, 3.3 Communication- purpose, barrier to communication. 3.4 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	12	8	CO1 CO2 CO3

3.5 Housekeeping: Definition, Responsibility of management and employees, Advantages of good housekeeping, 5 s of housekeeping. 3.6 Work permit system- objectives, hot work and cold work permits. 3.7 Entry into confined spaces.			
4 SAFETY IN MATERIAL HANDLING			
4.1 Classification of safety in Material Handling; 4.2 Manual Handling; kinetic method of lifting 4.3 Fall- Definitions; Causes of common fall 4.4 Types of falls and safety regarding falls. 4.5 Inbuilt safety in cranes, hoist and lift, chain pulley block, Mixers, conveyors	12	6	CO1 CO2 CO3
5 **HAZARDS IN INDUSTRY & THEIR PREVENTION**			
5.1 Fire hazards and prevention: Types of Fires and relevant Extinguishers, Fire detection sensors 5.2 Machine Hazard: Types of machine hazards Common safeguarding methods and devices; 5.3 Hazards in chemical industry: classification of hazardous chemicals; properties of flammable chemicals; 5.4 safety in storage and transportation of flammable fluids; 5.5 Types of chemical emergencies and their prevention. 5.6 Noise: Introduction to noise; Effect of noise; Remedial measures to combat noise. 5.7 Electrical hazards 5.8 Personal protection in the work environment Types of Personal protective equipment-respiratory and non-respiratory equipment.	20	16	CO1 CO2 CO3 CO4
Total	**75**	**48**	

6. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies

7. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	Industrial Safety And Factories Act	8	11
2	Accident & Insurance Coverage	10	20
3	Safety Education & Housekeeping	8	12
4	Safety In Material Handling	6	12
5	Hazard In Industry & Their Prevention	16	20
	Total	48	75

8. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	Practicals (At least Six))	Marks
1.	Visit to the Inspectorate of Factories & Boilers /safety agency and Prepare the report on safety measures followed in the industry.	
2.	Conduct a mock drill to handle emergency situation in the Institute.	
3.	Survey a nearby market and prepare a report on safety equipment and their specification available in market.	
4.	Prepare at least one safety poster or safety display that can be used in surrounding area	
5.	Prepare a report on root cause analysis of an industrial accident.	
6.	Identify different types of fires and select appropriate fire extinguisher	
7.	Select appropriate PPE for industrial environment	
8.	Prepare an action plan for disposal of industrial waste for prevention of health hazards.	
	Total	25

9. LEARNING RESOURCES

9.1 Text Books

S. No.	Author	Title of Books	Publishers
1	NaseerElahi	Industrial Safety Management	Kalpaz Publication 2006
2	H.l. kalia	Industrial Safety And Human Behavior	Aitbs Publishers, India
3	A. N. Saxena	Industrial Safety	National Productivity Council 1978

(FB 613) SURFACE TREATMENT & CORROSION PREVENTION

1. COURSE OBJECTIVES

In Fabrication Engineering, corrosion is the natural phenomenon which continuously strives to destroy the fabricated products to cause huge loss of property. This course is intended to arm the Fabrication engineer with the theory of corrosion, surface preparation and corrosion prevention methods, to eliminate or reduce the losses due to corrosion.

2. TEACHING AND EXAMINATION SCHEME

Semester	VI								
Course code & course title		Periods/Week (in hours)			Total Hours	Examination Scheme			
						Theory Marks		Practical Marks		Total Marks
		L	T	P	H	TH	TM	TW	PR/OR	
FE613 SURFACE TREATMENT & CORROSION PREVENTION		3	0	2	5	75	25	25	25	150

3. COURSE OUTCOMES:

On successful completion of the course, the student will be able to:

FE613.CO1.Acquire the knowledge of Theory of Corrosion, types of Corrosion, types of SurfacePreparation, and types of Corrosion Prevention.

FE613. CO2.Identify various types of corrosion.

FE613.CO3.Select appropriate corrosion prevention method.FE613.CO4. Evaluate rate of corrosion.

4. Mapping Course Outcomes with Program Outcomes

Relationship : Low-1 Medium-2 High-3

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific knowledge	Problem Analysis	Design & development of Solutions	Engineering tools, Experimentation and practice	Engineering practices for society , sustainability and Environment	Project Management	Life-long learning
CO 1	3	1	1	1	1	3	3
CO 2	3	3	1	1	1	3	3
CO 3	3	3	3	1	3	3	3
CO 4	3	3	3	3	3	3	3

	PSO1	PSO2
CO1	3	3
CO2	3	3
CO3	3	3
CO4	3	2

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	**Thr = Teaching hours**	**CO = Course Objectives**			
Unit			**M**	**T hr**	**CO**
1 UNIT NAME THEORY OF CORROSION					
1.1 Definition of corrosion			3	2	CO1
1.2 Effects of corrosion					CO1
1.3 Classification of corrosion: Uniform and Localized, Macroscopic and Microscopic					CO1
1.4 Corrosion rate expressions			6		CO1, CO4
1.5 electro-chemical aspects: electro-chemical reactions, polarization, passivity					CO1
1.6 Environmental effects-effect of oxygen and oxidizers, effect of velocity, effect of temperature, Effects of corrosive concentration, effect of galvanic coupling.				4	CO1
1.7 Metallurgical aspects: metallic properties					CO1
			9	**6**	
2 TYPES OF CORROSION					
2.1 Uniform corrosion			3	1	CO1, CO2
2.2 Galvanic or Two –Metal corrosion, EMF and Galvanic series, environmental effects, distance effect, area effect					CO1, CO2
2.3 Crevice corrosion			3	1	CO1, CO2
2.4 Filiform corrosion				1	CO1, CO2
2.5 Pitting, Pit shape and growth, autocatalytic nature of Pitting, evaluation of pitting damage			6	3	CO1, CO2
2.6 Selective leaching, Dezincification, Graphitization, other alloys systems				2	CO1, CO2
2.7 Erosion Corrosion, Surface films, velocity, turbulence, impingement, galvanic effect, nature of metal or alloy, cavitation damage, fretting corrosion.			6	2	CO1, CO2
2.8 Intergranular corrosion, Austenitic stainless steels, weld decay, methods to prevent weld decay, knife-line attack				3	CO1, CO2
2.9 Stress corrosion, Crack morphology, stress effects, time to cracking, corrosion fatigue.			6	3	CO1, CO2
2.10 Hydrogen damage, hydrogen blistering, hydrogen Embrittlement				2	CO1, CO2
			24	**18**	
3 SURFACE PREPARATION					
3.1 Types of surface preparation			3	1	CO1
3.2 Types of Blasting, sand blasting, quartz blasting, shot blasting, shot peening, hydroblasting.					CO1
3.3 Types of Tumbling and cleaning, Barrel tumbling, rotary blast tumbling.			3	1	CO1
3.4 Types of Barreling, Burnishing, barreling.					CO1
3.5 Cleaning of steel by solution and vapors, degreasing, cold solvent washing, acidcleaning, cleaning by steam gun, rotary spray brush cleaning.			6	4	CO1
3.6 Cleaning of steel by acid, descaling, acidpickling.					CO1
3.7 Cleaning of steel by salt bath, sodium hydride process, sodium hydroxide baths, Kolene process.			6	4	CO1
3.8 Electrolytic Cleaning, Electrolytic degreasing, Electrolytic pickling.					CO1

	18	**10**	

4 BASIC CORROSION PREVENTION			
4.1 Corrosion prevention by Material selection, metals and alloys, metal purification, non metallics	3	2	CO1, CO3
4.2 Corrosion prevention by Barrier coating, Metallic coatings, electrodeposition, flame spraying , cladding, hot dipping, vapor deposition, Inorganic coatings, spraying, diffusion, chemical conversion, Surface modification, Laser surface alloying, Ion implantation, Organic coatings	9	5	CO1, CO3
4.3 Corrosion prevention by Alteration of the environment, changing the environment, using Inhibitors	3	2	CO1, CO3
	15	**9**	
5 ADVANCED CORROSION PREVENTION.			
5.1 Corrosion prevention by Design, wall thickness, design rules	3	1	CO1, CO3
5.2 Corrosion prevention by Cathodic and Anodic Protection, Cathodic protection, Anodic protection, Comparison of Cathodic and Anodic Protection.	6	4	CO1, CO3
	9	**5**	
Total	**75**	**48**	**-**

6. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies

7. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	THEORY OF CORROSION	6	9
2	TYPES OF CORROSION	18	26
3	SURFACE PREPARATION	10	16
4	BASIC CORROSION PREVENTION	9	14
5	ADVANCED CORROSION PREVENTION.	5	10
	Total	48	75

8. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	Practical	Marks
1	Demonstration to measure corrosion rate on M.S. samples in sea water by weight loss/ gain method.	5
2	Demonstration of surface preparation & treatment on metals	5
3	Demonstration on corrosion prevention methods like – Paint coating, Electroplating (Nickel plating, Zinc plating), Anodising, Phosphating, Tinning, Galvanizing.	5
4	Three industrial visits to study the causes, effects of corrosion and its prevention methods.	5
5	Study of corrosion rate by accelerated methods (Potentiostatic)	5
	Total	25

9. LEARNING RESOURCESText

Books

S. No.	Author	Title of Books	Publishers
1	Mars G. Fontana	Corrosion Engineering	McGraw-Hill
2	G.A. Balalaev	Corrosion Prevention Practice	Mir Publishers, Moscow
3	Eric M Simons	The Surface Treatment of Steel	Sir Issac Pitman and Sons, London

Reference Books for further study

S. No.	Author	Title of Books	Publishers
1	Edited by Richard W. Greene and the staff of Chemical Engineering	The Chemical Engg Guide to Corrosion Control in the Process, Industries	McGraw Hill Publication Co. New York.
2	Edited by Staff of Chemical Engg	Controlling Corrosion in Process Equipment	McGraw Hill Publication Co. New York.
3	Editor V. E. Carter	Corrosion Testing for Metal Finishing	Butterworth Scientifica London.

SEMESTER	COURSE CODE	NAME OF COURSE	TEACHING SCHEME				EXAMINATION SCHEME				Total Marks
							Theory		Practical		
			L	T	P	H	TH	TM	PR	TW	
SEVENTH	AC102	Indian Constitution	2	0	0	2	-	-	-	-	-
	CC501	Entrepreneurship Development	0	0	2	2	-	-	-	25	25
	FB701	Structural Steel Design	4	0	4	8	75	25	25	25	150
	FB702	Fabrication Estimation & Costing	4	0	2	6	75	25	-	25	125
	FB703	Fabrication Boilers & Pressure Vessels	3	0	2	5	75	25	25	25	150
	FB704	Fabrication Project	0	0	6	6	-	-	50	100	150
		Elective-II	3	0	2	5	75	25	25	25	150
		Total	16	0	18	34	300	100	125	225	750

(AC 102) INDIAN CONSTITUTION

1. COURSE OBJECTIVES:

As a proud citizen of this country every student must be aware about the Indian Constitution to appreciate the provisions available for the people of this biggest democracy in Indian Constitution so that the youth ofthis country plays active role in development of the country by participating in the formation of sensitive and proactive Government at national and state level. This course intends to make students aware about various constituents of the Indian Constitution.

2. TEACHING AND EXAMINATION SCHEME:

Semester	VI								
Course Code & Course Title		Periods/Week (in hours)			Total Hours	Examination Scheme			
						Theory Marks		Practical Marks		Total Marks
(AC102) INDIAN CONSTITUTION		L	T	P	C	TH	TM	TW	PR/OR	
		2	0	0	2	0	0	0	0	-

3. COURSE CONTENT

UNIT 1: The Constitution – Introduction • The History of the Making of the Indian Constitution • Preamble and the Basic Structure, and its interpretation • Fundamental Rights and Duties and their interpretation • State Policy Principles
UNIT 2: Union Government • Structure of the Indian Union • President- Role and Power • Prime Minister and Council of Ministers • Lok Sabha and Rajya Sabha
UNIT 3: State Government • Governor- Role and Power • Chief Minister and Council of Ministers • State Secretariat
UNIT 4: Local Administration • District Administration • Municipal Corporation • Zila Panchayat

UNIT 5: Election Commission

- Role and Functioning
- Chief Election Commissioner
- State Election Commissioner

Suggested Learning Resources:

S. No.	Title of Book	Author	Publication
1	Ethics and Politics of the Indian Constitution	Rajeev Bhargava	Oxford University Press, New Delhi,2008
2	The Constitution of India	B. L. Fadia	Sahitya Bhawan; New edition (2017)
3	Introduction to the Constitution of India	D D Basu	Lexis Nexis; Twenty – Third 2018 edition

Suggested Software/ Learning Websites:

a. https://www.constitution.org/cons/india/const.html
b. http://www.legislative.gov.in/constitution-of-india
c. https://www.sci.gov.in/constitution
d. https://www.toppr.com/guides/civics/the-indian-constitution/the-constitution-of-india/

(CC501) ENTREPRENEURSHIP DEVELOPMENT

1. COURSE OBJECTIVES:

Student will be able to start his own venture with all fundamentals of business. Today Entrepreneurship is given importance by the government to bring the youth of our country to overcome the problem of unemployment and bring them in the main stream of global business to strengthen Indian economy by Make in India philosophy. Government has announced various financial schemes for young youth and women to support them for setting up an enterprise. To fulfill this, youth are to be prepared for setting an enterprise. The students undergoing this course will develop entrepreneurial traits and confidence within themselves and choose entrepreneurship as a career to brighten their future.

2. TEACHING AND EXAMINATION SCHEME

Course Code & Course Title	Periods/ Week (In Hours)			Total Credits	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
CS501 Entrepreneurship Development	**L**	**T**	**P**	**C**	**-**	**-**	**PR/OR**	**TW**	25
	-	-	2	2	-	-	-	25	

3. COURSE OUTCOMES:

CC501CO1: List the terms associated with Entrepreneurship Development. CC501CO2: Explain the terminologies and procedures involved in Entrepreneurship Development

CC501CO3: Identify legal implications for Entrepreneurs.

CC501CO4: Develop the project report for new enterprise.

4. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO1	PSO2
CO1	1	0	0	0	2	3	2	1	1
CO2	1	0	0	0	1	3	2	1	1
CO3	0	1	2	0	0	0	2	1	1
CO4	3	2	2	0	2	0	2	1	1

Relationship : Low-1 Medium-2 High-3

5. DETAILED COURSE CONTENTS

M=Marks	Phr= Practical hours	CO – Course Outcomes			
Unit			M	Phr	CO
1 Introduction to Entrepreneurship Development				**4**	
1.1 Introduction to Entrepreneurship Development (EDP)					**CO1 CO2 CO3 CO4**
1.2 Entrepreneur definition, Types of Entrepreneur, Characteristics of entrepreneur and entrepreneurship					
1.3 Enterprises: Micro, Small and Medium Enterprises (MSME), Service industry, Manufacturing Industry, Franchises and Start up.					
1.4 Organisations: Sole proprietorship, Partnership, Public, Co-operative Society.					
2. Identification of business opportunity				**6**	
2.1 Business ideas- Exploring business ideas in terms of marketability, technical feasibility, financing and authorities					**CO1 CO2 CO3 CO4**
2.2 Business terms: - Clients, vendors market description, demand, supply, banking& non-banking, financing companies, Loans of various types, GST, peers Promoters, Lenders, Consortium.					
2.3Government Departments: - IDC, EDC, Civic Body, Pollution Control department.					
3. Market Research				**4**	
3.1 Data Collection: - Data collection of Business idea such as Number of players, Total demand, Total supply					**CO1 CO2 CO3 CO4**
3.2 Analysis of Data: - Analysis of data and projection of data with respect to various factor (such as GDP, Climate etc through case studies).					
3.1 Questionnaire: - Preparing a questionnaire for business idea to assess business opportunity.					
4. Legal Aspect				**10**	
4.1 Legal Financial Term: - Know the various terms such as Resources, Assets, Liabilities, Advances, Depreciations, Investments, Fixed Capital, Working Capital (cash credit), Employee Cost, Miscellaneous Expense, Other Income, Profit & Loss Statement, Cash Flow Analysis, and Balance Sheet.					**CO1 CO2 CO3 CO4**
4.2 Legal Aspects: - Procedure for Registration with various government agencies, GST, PAN, Slab of Income Tax. Difference in use of electricity, water & LPG for domestic purpose and industrial applications					

4.3 Business Analyses: - 1) Swot Analysis 2) Break – Even Analysis			

5. Project Report		**8**	
5.1 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, Schemes, Profitability and Projections, Infrastructure, Break Even Point, Names and Addresses of suppliers, remarks.			**CO1** **CO2** **CO3** **CO4**
5.2 Project Profile: - Project appraisal criteria: - Technical feasibility, Financial feasibility, Economic viability, Commercial viability, Managerial competency, Political and Labour considerations			
5.3 Scope of Business: - Further scope with Capital infusion, Exit plan Analysis.			
Total	**25**	**32**	

6.COURSE DELIVERY:

Videos / Lectures/ Practicals /Expert lectures / Industry visits

7. SPECIFICATION TABLE FOR PRACTICALS

Unit No.	Topic	Teaching Hours/ Semester	MARKS
1	**Entrepreneurship Development**	4	3
2	**Identification of business opportunity**	6	5
3	**Market Research**	4	3
4	**Legal Aspect**	10	8
5	**Project Report**	8	6
TOTAL		**32**	**25**

8. SPECIFICATION TABLE FOR TERM WORK & PRACTICAL HOURS

No	**Classroom Assignments**	**Marks**
1.	Prepare a Case Study on leading enterprise	
2.	Prepare a Case Study on small scale unit	
3.	Prepare a report on various government schemes for startup.	
4.	Prepare SWOT analysis for a new business idea.	
5.	Prepare Project Report for a new business idea.	

	Total	**25**

9. LEARNING RESOURCES

S.No.	Author	Title of Books	Publisher
1.	Sharad Jawadekar, Shobha Dodlani,	Business entrepreneurship	Suvicharprakashanmandal, pune,
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

(FB 701) STEEL STRUCTURES DESIGN

1. COURSE OBJECTIVES

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 students to acquire the knowledge of fundamental principles of steel structures and relevant Indian Standard codes of practicefor design and detailing of steel structures.

2. TEACHING AND EXAMINATION SCHEME

Semester	VII								
Course code & course title		Periods/Week (in hours)			Total Hours	Examination Scheme			
						Theory Marks		Practical Marks	Total Marks
FB701 STRUCTURAL STEEL DESIGN		L	T	P	H	TH	TM	TW	PR/OR	
		4	0	4	8	75	25	25	25	150

3. COURSE OUTCOMES:

On successful completion of the course, the student will be able to:

.CO1. Understand the principles of design of welded joints, bolted joints, tension members, compressionmembers beams, base plates and trusses.

.CO 2. Compute the loads on beams, columns and trusses.

.CO 3. Analyse the beams, truss members and columns and base plates

.CO 4. Design the beams, struts, columns, column bases, tension members with connectionsand the members of roof truss with bearing plate and purlins for trusses .

4. Mapping Course Outcomes with Program Outcomes

Relationship : Low-1 Medium-2 High-3

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific knowledge	Problem Analysis	Design & development of Solutions	Engineering tools, Experimentation and practice	Engineering practices for society , sustainability and Environment	Project Management	Life-long learning
CO 1	3	1	1	1	1	1	1
CO 2	3	3	2	1	1	2	2
CO 3	3	3	2	1	1	1	1
CO 4	3	3	3	1	2	2	2

	PSO1	PSO2
CO1	3	1
CO2	3	1
CO3	3	2
CO4	3	2

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks | **Thr = Teaching hours** | **CO = Course Objectives**			
	M	**Thr**	**CO**
UNIT 1 STEEL STRUCTURES			
1.1 Introduction to Steel Structures. Applications of structural steel, Advantages and disadvantages of steel structures, Grades of steel and strength characteristics; Types of loads on steel structures and analysis of loads as per I.S. 875-1987 (Part I, Part II & Part III) Different structural steel shapes- their properties and applications . Use of steel tables and relevant I.S. codes for structural steel design by Limit state method. Limit State for Steel Design-Limit states of strength, Limit states for serviceability and Design criteria .	**6**	**4**	**CO 1** **CO1**
1.2 CONNECTIONS a) Types of end connections---. i)Rivetted ii)Bolted iii)Welded Connections, Comparison of welded, bolted and riveted joints , advantages and disadvantages of welded joints. Types of welds i)Fillet ii)Butt iii)Slot iv) Plug welds , Fillet weld size, throat thickness, effective length , overlap of weld, weld symbols, recommended size of weld,partial safety factor for site and shop welds as per I.S.code provisions , Strength of welded joint. Specification for Bolted joint as per code provisions, Failure of Bolted Point-Shear failure, Bearing failure, Tension failure, Block shear failure. b) (Numerical problems on design of axially loaded fillet welds, butt welds and bolted connections)	**6**	**8**	**CO4** **CO1**
1.3 ECCENTRIC LOADING. Design procedure of eccentrically loaded fillet welded joint with moment in the plane of the welds and perpendicular to plane of welds. Design procedure on eccentrically loaded bolted joints with moments in the plane of the bolts	**6**	**4**	
UNIT 2 TENSION MEMBERS			
2.1 Introduction to Tension Members Suitability of different sections, Provisions for tension members as per IS Code. Type of Failures- i) Gross Section of Yielding, ii)Net Section Failure, iii)Block Shear Failure, Design Strength of Tension member. Introduction to Lug Angle and Tension splice.	3	6	CO1
2.2 Design of tension member for axial loads along with welded end connection using single angle , double angle and a channel section (Simple numerical problems)	12	9	CO4

UNIT 3 COMPRESSION MEMBERS			
3.1 Introduction to Compression Member. Types of Sections and their suitability, Effective length, Radius of gyration, slenderness ration and its limit, Short and Long Columns, effective length of columns, buckling load, Empirical methods—Euler's and Rankin's method of determination of buckling load, I.S code method of determination of design strength of columns,. IS Code provisions for permissible compressive stresses of compression members. Introduction to lacing and battening.	3	3	CO1
3.2 Design of compression members/columns of single and built up section (no lacing and battens design) with welded connections. (Simple numerical problems on design of column of single section with welded connections only)	9	9	CO4
3.3 Types of column bases, Design of slab base for column with PCC pedestal and with welded connections, (Simple design problems)	6	3	CO4
UNIT 4 FLEXURAL MEMBERS			
4.1 Steel Beams a)Type of sections of beams, Behaviour of beam in bending, Elastic and Plastic Section modulus , Classification of cross sections of beam, Lateral stability of beams, Factors governing the design of beams as per IS Code.---i) Plastic bending strength, ii)plastic shear resistance, iii)web buckling, iv)web crippling v)deflection. b) Simple numerical problems of design of I section beam with all necessary checks .	6	7	CO4
4.2 Plate Girders **(No Problems)** Introduction to Plate Girder: Various components and their functions, stiffeners and splices.	6	2	CO1
UNIT 5 ROOF TRUSSES			
5.1 Types of steel roof trusses & its selection criteria. Types of roof coverings. Loads on the roof truss and load combinations. Analysis of roof truss-- determination of loads at panel points and calculation of internal force in members of truss by method of joints or graphical method.	6	4	CO1, CO2,
5.2 Design of members of steel truss with welded connections. Design of angle purlins and I section , channel purlin Design of end bearing of truss Problems on load calculation of truss, design of members of truss , design of angle , channel and I section purlin	6	5	CO4
Total	**75**	**64**	

6. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies

7. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	Steel Structures	16	18
2	Tension Members	15	15
3	Compression Members	15	18
4	Flexural Members	9	12
5	Roof Trusses	9	12
	Total	64	75

8. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

Intellectual skills:

1. Interpret Architectural drawing
2. Analyse the data for design.
3. Design component parts of steel-framed-building.

Motor Skills:

1. Draw proportionate sketches.
2. Detailed layout of steel roof truss
3. Prepare drawing details
4. Draw constructional details.

No	Practical	Marks
1	Sketch book shall comprise of the following items 1. Different Structural steel sections and their properties 2. Different types of compression and tension members. 3. Design and drawing of tension member of different types with welded end connection and bolted connection 4. Design and drawing of compression member of different types with welded end connection. 5. Single and double Lacing system for compression members 6. Column bases- design and drawing of slab base for I section column and stanchion. 7. Sketch of beam to beam to column framed connection and seated connection. 8. Welded and Rivetted girders (only detailing and no design) 1.	15
2	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.	**10**
...	Total	25

9. LEARNING RESOURCES Text Books

S. No.	Author	Title of Books	Publishers
1	N. Subramaniam	Design of steel structure	Tata Mcgraw Hill Publication Company ltd. New Delhi
2	S. K. Duggal	Design of steel structure	Tata Macgraw Hill Publication Company ltd. New Delhi
3	S. S. Bhavikatti	Design of steel structure	IK International Publishing House Ltd.
4	M. Raghupati	Design of steel structure	Tata Macgraw Hill publication Company ltd. New Delhi
5	Ramchandran	Design Of Steel Structures	Std Book House

Reference Books for further study

S. No.	Author	Title of Books	Publishers
1	L. S. Negi	Design of steel structure	Tata Macgraw Hill publication Company ltd. New Delhi
2	Ramchandra	Design of steel structure	Dalpatrai & Sonts publication Company ltd. New Delhi

Indian and International codes needed

S. No.	Author	Title of Books	Publishers
1	. IS 800-2007	Indian Standard code of practice for use of structural steel in general building construction,	BIS New Delhi.
2	. IS hand book No. 1	Properties of structural steel rolled section SP-16	BIS New Delhi.
3	IS-875 Part-1, 2, & 3- 1987	Indian Standard code of practice for use of structural steel in general building construction,	BIS New Delhi.
5	S. Ramamrutham	Steel Tables,	Dhanpat Rai publishing company ltd., New Delhi

Internet and Web Resources

S. No.	Author	Title of Books	Source
1	Gk. Balamuralikrishna	IS 800-2007-SlideShare	https://www.slideshare.net
2		Design- Steel Construction.info	https://steelconstruction.info

Videos and Multimedia Tutorials

S. No.	Author	Title of Books	Source
1	NPTEL	Videos ,pdf's on structural steel design	http://nptel.ac.in

(FB 702) FABRICATION ESTIMATION & COSTING

1. COURSE OBJECTIVES

A technician in a fabrication and erection industry is required to prepare various types of estimates forsteel structures and also to find out the costs before the proposal for the execution of work. The course content is designed to give the necessary knowledge in the preparation of estimate for structural steel work, building estimate and various types of contracts and tenders.

The course content is designed to give necessary knowledge in the preparation of estimates for fabricationwork including turning, milling, shaping, welding, riveting and machining.

2. TEACHING AND EXAMINATION SCHEME

Semester	**VII**								
Course code & course title		**Periods/Week (in hours)**			**Total Hours**	**Examination Scheme**			
						Theory Marks		**Practical Marks**		**Total Marks**
FB 702 CIVIL ESTIMATION & COSTING		**L**	**T**	**P**	**H**	**TH**	**TM**	**TW**	**PR/OR**	
		4	0	2	6	75	25	25	-	125

3. COURSE OUTCOMES:

On successful completion of the course, the student will be able to:

FB702.CO1. State units of measurement for different items of work, purpose of estimation & costingand different types of estimates.

FB702.CO2. Understand Specifications, the process of Estimating quantities, Schedule of rates, Bill ofQuantities, Billing and concept of contract and tendering

FB702.CO3. Prepare rate analysis for given item of work/job and estimate cost / time for steel works /fabrication jobs.

FB702.CO4. Scrutinize tenders for award of works.

4. Mapping Course Outcomes with Program Outcomes

Relationship : Low-1 Medium-2 High-3

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific knowledge	Problem Analysis	Design & development of Solutions	Engineering tools, Experimentation and practice	Engineering practices for society , sustainability and Environment	Project Management	Life-long learning
CO 1	3	3	---	---	-----	----	1
CO 2	3	2	---	---	3	3	3
CO 3	3	3	3	-----	3	3	3
CO 4	2	3	1	-----	3	3	3

	PSO1	PSO2
CO1	3	1
CO2	3	1
CO3	3	1

CO4	3	3

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	**Thr = Teaching hours**	**CO = Course Objectives**			
Unit			**M**	**Thr**	**CO**
1 Estimation			15	12	
1.1 Definition of estimation, Purpose of estimation Different types of estimates Data required for preparing detailed estimates Factor to be considered for estimation Scheduled of rates Bill of Quantities (B.O.Q)			03	03	CO1
1.2 Approximate Estimate Types of Approximate Estimate of Buildings, Material and Labour Cost, Water supply, sanitary and Electrification works costs			03	03	CO1
1.3 Principle units for various items of works and materials Limits of measurement and degree of accuracy in estimating different methods for estimating building works			03	03	CO1
1.4 Definition of specification and its necessity. Types of specification, specification for i) Steel doors and windows ii) AC Sheet Roofing iii) Painting iv)Welding			06	03	C02
2 Estimation of Structural Steel work			15	12	
2.1 Units of measurements for rolled steel sections, steel plates, tubular sections, sliding doors, rolling shutters ,collapsible gates, grills, expanded metal work, plain sheets, holding down bolts including nut and washers , steel grillage, rivets, welding, bents, cables guy wires and barbed wire			03	03	CO2
2.2 Estimation of quantity of structural steel as per IS-1200 part VIII specification and to prepare measurement sheet, abstract sheet.			06	06	CO2
2.3 Preparation of bills for structural steel work			06	03	CO1,CO2
3 Contracts and Tender Notice			06	06	
3.1 Definition, requirements of valid contracts, forms of contracts, condition of contracts, contract documents, schedule of material supplied by the owners and specification. Security deposit time limit , mode of measurement, terms of payment , execution of work , breach of contract and arbitration			03	03	CO3

3.2 Types of contract- Lump sum contract, percentage rate contract and item rate contract with their merits & demerits; Definition of tender notice, necessary information in the tender notice , earnest money deposit, submission of tenders, scrutiny of tenders, Award of tender/work.	03	03	CO3, CO4

4 Introduction to Mechanical Estimation	**06**	**04**	
4.1Concept of Estimating, its purpose 4.2Function of Estimator 4.3 Functions of Estimation Department 4.4 Procedure of Estimating..	06	04	CO1, CO3
5 ESTIMATION IN MACHINE SHOP / WELDING /SHEET METAL WORKS	33	30	
5.1Machine shop i) 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 ii) estimation of drilling time on drilling machine; iii) estimation of shaping, planning and slotting time; iv) estimation of grinding time; v) estimation of milling time; vi) Numerical examples; Allowances- personal, fatigue, tool changing and grinding, startup and shut down, set-up and change over, rejection and rework, loading and unloading measurements and checking, learning, training and implementation, policy allowances.	12	10	CO1, CO2, CO3
5.2Welding i) Components of welding cost- labour, consumables, equipment cost, power cost, overhead ii) Basic costing procedure- arc welding, gas welding. iii) Factors affecting welding cost. iv) American Welding Society Welding Estimation Sheet. Numerical examples	09	10	CO1, CO2, CO3, CO4
5.3 Sheet Metal Works i) Sheet metal operations, ii) Sheet metal joints. iii) Press work operations. iv) Estimation of Sheet metal operation time. v) Numerical examples	12	10	CO1, CO2, CO3, CO4
Total	**75**	**64**	-

6. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies

7. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	Estimation and purpose	03	03
2	Types of Estimate	03	03
3	Units of measurement	03	06
4	Specifications	03	03
5	Estimation of Structural Steel work	12	15
6	Contracts and Tender Notice, case study for award of tender.	06	06
7	Introduction to Mechanical Estimation	04	06
8	Estimation in machine shop	10	12

9	Estimation of welding	10	09
10	Estimation of sheet metal works	10	12

	TOTAL	64	75

8. SPECIFICATION TABLE FOR TERM WORK

No	Practical	Marks
1	Preparation of Measurement Sheet & abstract Sheet for structural steel work for at least two – roof truss, frame structure, plate girder, a water tank	10
2	Drafting of Tender Notice	3
3	Problems on machine shop estimation covering all the operations.- Minimum 04 problems to be solved	4
4	Problems of welding estimation- Minimum 02 problems to be solved, one involving Arc welding processes and one using gas or advanced welding process.	4
5	Problems on sheet metal shop estimation. One problem on a job having hem joint, other sheet metal operations.	4
	Total	25

9. LEARNING RESOURCESText

Books

S. No.	Author	Title of Books	Publishers
1	M. Chakraborti	Estimation Costing Specifications & Valuation in Civil Engg	M. Chakraborti Kolkata
2	B.S. Patil	Civil Engg. Contract and Estimation	Orient Lorgman
3	B.N. Datta	Estimation & Costing in Civil Engineering	UBS Publishers
4	-------	I.S. Codes 1200 part VIII	-------
5	.P.W.D Section	Schedule of Rates for the current year	Govt OF Goa
6	S. Ramamruthan	Steel Tables	Dhanpat Rai & Company
7	T.R. Banga, S.C. Sharma	Mechanical Estimation and costing	Khanna publishers
8	Malhotra	Mechanical Estimation	-
9	NITTTR Madras	Mechanical Estimation and costing	NITTTR Madras
10	Singh and Khan	Mechanical Costing and Estimation	Khanna Publishers
11	M. Adithan	Process planning and cost estimation	New Age International
12	V.K. Manchanda, D.R. Singla, K.B. Agarwal	Mechanical Estimation and Costing	Katson Publishing House

Reference Books for further study

S. No.	Author	Title of Books	Publishers
1	R.L.Peurifoy & G.D.Oberlender	Estimating Construction Costs	MeGraw–Hill Publication 5th Edition

Internet and Web Resources

S. No.	Author	Title of Books	Publishers
1	Estimator -2	Quantity ,Cost, Estimation &Project Management Software	

2	NPTEL	Estimation and Costing Lectures	NPTEL

Videos and Multimedia Tutorials

S. No.	Author	Title of Books	Publishers
1	Estimator-Civil Engineering Estimation Software-CESDb	https://www.cesdb.com	
2	NPTEL	Civil Engineering Construction Economics&Finance	https://nptel.ac.in
3	Learning Construction Estimating-Lynda.com	https://www.lynda.com	
4	Mokhtar Ahmed	Karnataka Diploma Estimation And Costing - Estimation of cost in Machine Shope - Part 1	You tube
5	Prof.A.B.Chattopadhyay, Prof. A. K. Chattopadhyay and Prof. S. Paul,Department of Mechanical Engineering, IIT Kharagpur	Lecture - 25 Estimation of Machining Time	NPTEL You tube
6	CIM Solutions	Estimate machining times and cost	You tube
7	MECH TECH12	What Is Cnc Machine Cutting Speed, Feed, Rpm And Depth Of Cut And How It Is Calculate In Hindi?	You tube
8	CKonnect SolidWorks Reseller India	Cost estimation of a component using SOLIDWORKS	You tube
9	sankethika	M 302 Estimation of Fabrication Cost	You tube

(FB703) FABRICATION OF BOILERS & PRESSURE VESSELS

1. COURSE OBJECTIVES

Boilers and Pressure Vessels are containers used to handle fluids which are highly toxic, compressible and which work at high pressures. Pressure vessels have applications in variety of industries such as Oil and Gas, Petroleum, Beverage industries, chemical industries, power generation industries, food industry, etc. Failure of pressure vessels has adverse effects on the surrounding and the industry which can cause loss of life, property and damages. The design of pressure vessel depends on factors such as pressure, temperature, material selected, corrosion, loadings, and many other parameters depending on the applications. This necessitates the study of fabrication processes to reduce failures in the pressure vessels and study of the parameters such as material selection, operating pressure and temperature, design, analysis, etc. which cause fatigue failure or stress concentration in the vessels.

2. TEACHING AND EXAMINATION SCHEME

Semester	**VII**								
Course code & course title		**Periods/Week (in hours)**			**Total Hours**	**Examination Scheme**			
						Theory Marks		**Practical Marks**		**Total Marks**
FB703 FABRICATION OF BOILERS & PRESSURE VESSELS		**L**	**T**	**P**	**H**	**TH**	**TM**	**TW**	**PR/OR**	
		3	0	2	5	75	25	25	25	150

3. COURSE OUTCOMES:

On successful completion of the course, the student will be able to:

FB703.CO1. Choose the most suitable fabrication process and tools of manufacture of vesselsFB703.CO2. Apply the methods of stiffening and strengthening the vessels.

FB703.CO3. Examine the stresses developed in pressure vessels for the purpose of design, inspection andtesting.

FB703.CO4. Outline the standard codes of practices in fabrication of pressure vessels.

4. Mapping Course Outcomes with Program Outcomes

Relationship : Low-1 Medium-2 High-3

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific knowledge	Problem Analysis	Design & development of Solutions	Engineering tools, Experimentation and practice	Engineering practices for society , sustainability and Environment	Project Management	Life-long learning
CO 1	3	2	2	2	1	1	2
CO 2	3	2	2	2	1	1	2
CO 3	3	2	3	2	1	1	2
CO 4	3	2	2	2	1	1	2

	PSO1	PSO2
CO1	3	2

CO2	2	3
CO3	2	3
CO4	2	2

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	**Thr = Teaching hours**	**CO = Course Objectives**			
Unit			**M**	**Thr**	**CO**
1 Construction material and press work					
1.1 Selection of construction materials: General Consideration, Non-corrosive service, Corrosive service, Bolting materials, Stainless steel, Selection of steel for hydrogen service, Aluminum alloys. Introduction to ASME, ASTM construction material, Boiler and Pressure vessel code (BPVC). 1.2 Types of Presses: Hand operated - Fly press, Power operated — Mechanical and Hydraulic, Gap Frame Presses, Straight- side presses. 1.3 Press Operations (brief description) a. Blanking, b. Piercing, c. Notching, d. Forming , e. Trimming. f. Flanging, g. Drawing, h. Lancing, i. Embossing, j. Re-striking, k. Flattening			15	10	CO1,CO4

2 Bending and Press Braking			
2.1 Bending -Mechanism of Bending, Spring back Methods to compensate for spring back, 2.2 Basic bending methods, Bending Allowances, Centre line bend allowance, Precision bend allowances. 2.3 Bending Machines - Press Brake, Universal folding machine, Hydroforming folding machine. 2.4 Press Braking- 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- 2.5 Producing structural sections like angles channels, Z-sections, hat sections and complex sections etc. and sequence of bend in each. Limitations of Press Breaking, Safety. 2.6 Bending of structural members - Forming the frame, forming an external angle ring, Angle ring bending rolls. 2.7 Roll Bending -Introduction, Shapes produced, Metal thickness, Diameter and Width, 2.8 Roll bending Machine- (i) Pinch type and (ii) Pyramid type, Pinch type rolls - Roll-up, Roll-down 'type, Three-roll type, Four- roll type. Pyramid type - Three roll type, three rolls with adjustable bottom rollers. Vertical plate bending machine. Rolling of truncated cone. Slip rolls. Safety in roll bending. 2.9 Roll forming –introduction and process	15	12	CO1,CO2
3 Tube Bending, forming and Spinning			
3.1 Principle of bending, Selection of bending methods- hand v/s power bending, form block, 3.2 Clamping blocks, pressure dies, wiper dies, mandrels, loose fillers, resins, dies, formed rolls. Bending tubes and pipes with a mandrel — plug and formed mandrels, ball mandrels, and dimensional accuracy. Bending tubing without mandrel. Tube and Pipe Bending Machines: Compression and Draw Pipe Bending Processes. Powered rotary benders, bending presses, roll benders. Hot bending- localized heating for compression bend. Bending thin wall tubes - machines, tools, materials, production examples. Lubrication for tube bending. 3.3 Spinning: Introduction to metal spinning, spinning lathes, spinning processes- Hand spinning. Hand forming tools for metal spinning, lubrication for spinning, Spindle speeds for spinning.	15	8	CO1,CO2
4 Stiffening and strengthening			

4.1 Reasons for Stiffening, Basic principle of stiffening, Methods of imparting stiffness to sheet metal. Single fold, Double return fold, Dished ends, Single hem, lightening holes, wiring, swaging, embossing, Use of stiffeners, Profile sheet, Methods of Stiffening large panels. 4.2 Use of applied stiffeners, Use of angle stiffeners, Stiffening of containers and tanks. 4.3 Strengthening at stress concentration areas.	15	8	CO2

5 Design, Inspection, Testing and failure of pressure vessels			
5.1 Introduction, 5.2 Design pressure, Design temperature, Dead loads, Wind loads, Piping loads, Earthquake loads and Combination of design load. 5.3 Stresses in cylindrical shells (thick and thin), Stresses in spherical shells (thick and thin), Discontinuity stresses in vessels, Stresses in bimetallic joints, Thermal stresses. 5.4 Corrosion failure, Stress failure, Design precautions, Buckling of P.V. under external load, Fatigue failure, Brittle facture. 5.5 Inspection and testing as per IBR, ASME Inspection during construction prior to welding, during welding. Hydro, pneumatic, vacuum test, their importance. Hydro test procedure. 5.6 Radiography, condition required, radiographs, interpretation of welding radiographs.	15	10	CO4
Total	**75**	**48**	-

6. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies

7. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	Construction material and press work	08	15
2	Bending and Press Braking	10	15
3	Tube Bending and forming	08	15
4	STIFFENING AND STRENGTHENING	08	15
5	Design, Inspection, Testing and failure of pressure vessels	08	15
	Total	48	75

8. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	Practical	Marks
1	Fabricating sections likes angles, channels, Z- section etc. from M.S. sheets by bending.	25
2	Fabrication a cylinder/truncated cone of M.S. sheets	25
3	Preparing hole profile for header pipe and end profile of branch pipe	25
4	Fabricating pipe intersection joints by welding as per profile in item no. 3	25
5	Fabricating pipe bends by cutting and welding.	25
6	Industrial visit for observing the operation of boilers and pressure vessels	25
7	*Note: File to be prepared in standard and uniform format for each of the above exercise.*	25
	Average of Total	25

9. LEARNING RESOURCESText

Books

S. No.	Author	Title of Books	Publishers
1	F. J. M. Smith, Longman.	Basic Fabrication and Welding Engg	
2	K.J. Cooper and T.P. Greenwood	Technician Fabrication and Welding	Cassels TEC Series.
3	R.W. Nichols	Development for P.V Tech-I	
4	John F. Harvey	Modern Pressure Vessels	
5	Henry H. Bednar.	Pressure Vessels Design Handbook	
6	R.W. Nichols	Pressure Vessel Engg. Technology	
7	M.V. Joshi	Process Equipment Design	Macmilan Inda Ltd. Delhi

Reference Books for further study

S. No.	Author	Title of Books	Publishers
1	ASME	Pressure Vessels - ASME code Book Welding, Welding procedure, chapter 6 pa 15	American Society Of Mechanical Engineers
2	ASME	Metals Handbook- volume 4 (Eighth Edition) -Forming	American Society for metal

Indian and International codes needed

S. No.	Author	Title of Books	Publishers
1	Directorate of Boilers	IBR -1950	Government of West Bengal
2	ASME	ASME BPVC Section II - Materials ASME BPVC Section V - Non-destructive Examination ASME BPVC Section VIII - Rules for Construction of Pressure Vessels	ASME

Internet and Web Resources

S. No.	Author	Title of Books	Publishers
1	NPTEL	Design of Cylinders and Pressure vessles –I, II, III	NPTEL Youtube.
2	Nosstec	Bending Roll Machine	NosstecAB

Videos and Multimedia Tutorials

S. No.	Author	Title of Books	Publishers
1	CochranLtd	Cochran - Boiler Manufacturing Process	CochranLtd You tube
2	datumsuman74	Thermax Manufacturing Engg.	You tube

(FB 704) FABRICATION PROJECT

1. COURSE OBJECTIVES

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 is 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

Semester **VII**									
Course code & course title	**Periods/Week (in hours)**			**Total Hours**	**Examination Scheme**				
					Theory Marks		**Practical Marks**		**Total Marks**
FB704 FABRICATION PROJECT	**L**	**T**	**P**	**H**	**TH**	**TM**	**TW**	**PR/OR**	
	0	0	6	6	-	-	100	50	150

3. COURSE OUTCOMES:

On successful completion of the course, the student will be able to:FB704.CO1. Identify the need of society /industry of engineering FB704. CO2. Literature Survey and collection of Data.

FB704.CO3. Apply Engineering Knowledge in arriving at innovative solutionsFB704.CO4. Design and Fabricate the project

4. Mapping Course Outcomes with Program Outcomes

Relationship : Low-1 Medium-2 High-3

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific knowledge	Problem Analysis	Design & development of Solutions	Engineering tools, Experimentation and practice	Engineering practices for society , sustainability and Environment	Project Management	Life-long learning
CO 1	3	3	1	1	2		1
CO 2	3	1	1	2	1		1
CO 3	3	3	3	3	2	2	1
CO 4	1	2	3	3	3	3	2

	PSO1	PSO2
CO1	1	2
CO2	2	2
CO3	3	2
CO4	2	3

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

1. **GROUP INFORMATION & 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 Sponsor of project

6. **FABRICATION**:-Fabricating the structure in the department workshop /site

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

6. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies

7. SPECIFICATION TABLE FOR PROJECT REVIEW

No	Project activity	Marks
1.	Selection area of project	**10**
2.	Literature survey, study of component, equipment, machine, plant, layout, etc.	**10**
3.	Defining problems, setting goals.	**20**
4.	Generating alternatives	**10**
5.	Developing a useful solution	**20**
6.	Testing a useful solution for feedback	**10**
7.	Report writing	**20**
	Total	**100**

PROJECT REVIEW SCHEDULE

SR.NO	REVIEW NO	WEEK OF SEMESTER
1	Review 1 (For Project Activities 1,2,3)	Second Week
2	Review 2(For Project Activities 4,5)	Seventh Week
3	Review 3(For Project Activities 5,6)	Twelfth Week
4	Review 4(For Project Activities 6,7)	Fifteenth Week

Note: In the project review assessment to be done based on

1) **Presentation made by the students showing the progress of their project.**
2) **Involvement and contribution of individual student in project group.**
3) **Uniqueness of project**
4) **Project Guide should strictly follow the project review schedule.**

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 50 marks

(FB 711) COMPUTER NUMERICAL CONTROL MACHINES

1. COURSE OBJECTIVES

This subject is classified as core technology. It is intended to teach students facts, concepts, principle and procedures of computerized numerical machines, so that he can Supervise and operate CNC Machines.

Diploma engineering students are expected to know the fundamentals of the stream they choose, as well as have the basic inputs of latest developments happening around. One such area is the use of computers in all activities of fabrication industry. The course contents are such that the students will able to understand the modern manufacturing systems, select, plan and execute the appropriate process for fabrication jobs. Inthis course, they will get hands-on experience of latest software and hardware used in fabrication technology.

2. TEACHING AND EXAMINATION SCHEME

Semester	**VII**								
Course code & course title		**Periods/Week (in hours)**			**Total Hours**	**Examination Scheme**			
						Theory Marks		**Practical Marks**		**Total Marks**
ME628 COMPUTER NUMERICAL CONTROL MACHINES		**L**	**T**	**P**	**H**	**TH**	**TM**	**TW**	**PR/OR**	
		3	-	2	5	75	25	25	25	150

3. COURSE OUTCOMES:

On successful completion of the course, the student will be able to:

ME628.CO1. Choose a suitable modeling software for further use in machining.

ME628.CO 2. Define the parameters, build models using CAD s/w for machining a job using CNCMachines

ME628.CO 3. Make use of G and M Codes for machining any job, or generate the codes using sequentialprogramming techniques and test these programs

ME628.CO 4. Solve problems of analysis of structures through popular software in civil engineering

4. Mapping Course Outcomes with Program Outcomes

Relationship : Low-1 Medium-2 High-3

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific knowledge	Problem Analysis	Design & development of Solutions	Engineering tools, Experimentation and practice	Engineering practices for society , sustainability and Environment	Project Management	Life-long learning
CO 1	3	2	1	2	2	2	3
CO 2	3	2	1	2	2	2	3
CO 3	3	2	1	2	2	2	3
CO 4	3	2	3	2	2	2	3

	PSO1	PSO2
CO1	3	2
CO2	2	2

CO3	3	3
CO4	3	3

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	**Thr = Teaching hours**	**CO = Course Objectives**			
Unit			**M**	**Thr**	**CO**
1 Modeling for CAD / CAM Purpose			10	8	CO1, CO2
1.1 2D Drafting 1.2 Extruding, Sweeping, Lofting, Revolving, Pattern –rectangular and polar 1.3 Boolean operations: Add, Subtract, intersect 1.4 Mass/Volume properties, Development, Sheet Metal Bending using software 1.5 Exporting Model for CNC operations; various formats of file transfer					
2 CNC Turning			15	10	CO1, CO2, CO3
2.1 Introduction to CNC technology – CNC Machines & controls. 2.2 History & development of CNC technology. 2.3 Numerical control on CNC machine tools CNC control and CNC 2.4 Control and types of CNC control 2.5 Calculation of technological data for CNC machining. 2.6 CNC clamping system. 2.7 CNC programming basics for turning exercises. 2.8 Introduction to manual NC programming, Manual NC programming for lathe. 2.9 Different types of tools and tool holders used on CNC Machines, parameters for selection of configuration of cutting tools. 2.10 Modular tools and fixtures, use of pallets for work holding, palletizing of fixtures.					
3 CNC Milling			15	10	CO1, CO2, CO3
3.1 Importing a CAD Model for machining 3.2 Setting up a job with coordinate for Home Position and Workpiece 3.3 Running a CNC Programme, dry run, air cutting, trial run 3.4 Sequential Programming fundamentals and trial on simple job 3.5 Advanced features: Canned Cycles, Subroutines 3.6 Advanced Tooling					

4 STAAD Pro Fundamentals	15	10	CO1, CO4
4.1 Model Generation and Editing 4.2 Assigning loads 4.3 Automatic load generations: 4.4 Slab, Wind and Moving loads 4.5 Concrete Design a. Column and Beam design 4.6 FEM / FEA 4.7 Water Tank Design 4.8 Slab Design 4.9 Staircase Design 4.10 Shear wall Design 4.11 Bridge Deck design 4.12 Steel Design 4.13 Steel Frame Structure Design a. Overhead Transmission b. Line Towers Design 4.14 Steel Structure design with Pushover Analysis 4.15 Foundation Designs a. Isolate, Combined, Strip, Mat and Pile Cap 4.16 Report Generation and Plotting Introduction to STAAD.Pro, Geometry creation, constants, supports, and Specifications.			
5 BASIC STATIC STRUCTURAL ANALYSIS USING ANSYS	20	10	CO1, CO4

5.1 Introduction to FEA 5.2 General Working of FEA 5.3 Nodes, Elements, and Element Shapes 5.4 General Procedure of Conducting Finite Element Analysis 5.5 FEA through ANSYS 5.6 Effective Utilization of FEA 5.7 FEA Software 5.8 Advantages and Limitations of FEA Software 5.9 Key Assumptions in FEA a. Assumptions Related to Geometry b. Assumptions Related to Material Properties c. Assumptions Related to Boundary Conditions d. Assumptions Related to Fasteners 5.10 Types of Analysis 5.11 Structural Analysis 5.12 Important Terms and Definitions a. Strength (Resistance to Deformation) b. Load c. Stress d. Strain e. Elastic Limit f. Ultimate Strength g. Factor of Safety				

h. Lateral Strain and Poisson's Ratio
i. Bulk Modulus
j. Creep
k. Engineering Materials

5.13 Introduction to ANSYS

a. System Requirements
b. Getting Started with ANSYS
c. Interactive Mode
d. Batch Mode
e. Utility Menu
f. Main Menu
g. Graphics Area
h. Standard Toolbar
i. ANSYS Command Prompt
j. Command Window Icon
k. Raise Hidden Icon
l. Reset Picking
m. Contact Manager
n. ANSYS Toolbar
o. Model Control Toolbar
p. User Prompt Information
q. Current Settings
r. Setting the Analysis Preferences
s. Units in ANSYS
t. Other Important Terms Related to ANSYS
u. Dialog Boxes
v. Graphics Display
w. Panning, Zooming, and Rotating the Model
x. Dividing the Graphics Area
y. The Pan-Zoom-Rotate Dialog Box
z. Graphics Picking
aa. Using Mouse Buttons for Picking
bb. ANSYS Database and Files
cc. Saving the File
dd. Resuming the File
ee. Clearing the Database
ff. Some Basic Steps in General Analysis Procedure
gg. Points to Remember while Performing an Analysis
hh. Exiting ANSYS
ii. Self-Evaluation Test

5.14 BASIC SOLID MODELING

a. Solid Modeling in ANSYS
b. Solid Modeling and Direct Generation

5.15 Solid Modeling Methods

a. Bottom-up Construction
b. Top-down Construction
c. Considerations before Creating a Model for Analysis
d. Details Required
e. Symmetry
f. Creating Geometric Entities

g. Creating Lines	

h. Creating Arcs
i. Creating B-Spines
j. Creating Fillets between Intersecting Lines
k. Creating Areas

5.16 Creating and Modifying Work planes

a. Display Working Plane
b. Show WP Status
c. WP Settings
d. Offset WP by Increments
e. Offset WP to
f. Align WP with

5.17 Coordinate Systems in ANSYS

a. Global Coordinate System
b. Local Coordinate System
c. Active Coordinate System
d. Display Coordinate System
e. Nodal Coordinate System
f. Element Coordinate System
g. Results Coordinate System
h. Creating New Coordinate Systems
i. Deleting Existing Coordinate

5.18 ADVANCED SOLID MODELING

Advanced Solid Modeling

a. Creating Volumes
b. Extruding Entities
c. Extending the Line
d. Creating Complex Solid Models by Performing Boolean Operations
e. Modifying the Solid Model
f. Scale
g. Move
h. Copy
i. Reflect
j. Deleting Solid Model Entities
k. Importing Solid Models

5.19 FINITE ELEMENT MODELING (FEM) – I

An Overview of the Finite Element Modeling

a. Element Attributes
b. Element Types
c. Real Constants
d. Material Properties
e. Multiple Attributes
f. Assigning Multiple Attributes before Meshing
g. Assigning Default Attributes before Meshing
h. Modifying Attributes after Meshing
i. Verifying Assigned Attributes
j. Element Attributes Table

5.20 FINITE ELEMENT MODELING (FEM) – II

a. Finite Element Modeling (FEM) - II
b. Mesh Generation
c. Mesh Density
d. Meshing the Solid Model

e. Setting Element Attributes
f. Defining the Mesh
g. Defining the Entity to be Meshed
h. Defining the Meshing Type
i. Meshing the Model
j. Refining the Mesh Locally
k. Extruding the Mesh
l. Transitional Pyramid Elements
m. Requirements for Creating Pyramid Elements
n. Creating Transitional Pyramid Elements (Hex-to-Tet Meshing)
o. Converting Degenerate Tetrahedral (20 nodes) Elements into
p. Non-degenerate (10 nodes) Tetrahedral Elements
q. Plotting Pyramid Elements
r. Meshing the Beam with Orientation Nodes
s. Creating the Beam Mesh with Orientation Nodes
t. Creating the Beam Mesh with Two Orientation Nodes
u. Improving the Tetrahedral Element Meshes
v. Improving Tetrahedral Meshed Volumes by Using Volumes
w. Improving Tetrahedral Meshed Volumes by Using Detached Elements
x. Some Additional Tips while Meshing the Model
y. Applying Loads
z. The Nodal Coordinate Systemaa.
Loads in Different Disciplines bb.
Types of Loads in ANSYS
cc. Load Steps, Sub steps, and Time dd.
Applying Loads
ee. Deleting Loads
ff. Deleting DOF Constraints
gg. Deleting all Loads and Load Step Options hh.
Deleting all Loads Applied on Solid Model
ii. Deleting all Loads Applied on Finite ElementModel

5.21 SOLUTION AND POSTPROCESSOR

a. Solution
b. Defining the New Analysis Type
c. Restarting the Analysis
d. Setting Solution Controls
e. Setting Analysis Options
f. Solving the Analysis Problem
g. Post processing the Result
h. POST1 (General Postprocessor)
i. Result Coordinate System (RSYS)
j. Displaying the Deformed Shape of the Model
k. Displaying the Minimum and Maximum Stresses
l. Listing Reaction Forces
m. Listing Stress Values at each Node
n. Query Picking

o. Path Operations p. Load Case Combinations 5.22 STATIC STRUCTURAL ANALYSIS a. Effect of self-weight on a cantilever beam b. Analysis of a bicycle handle c. Analysis of a stud (pin) d. Analysis of a master 5.23 GENERATING THE REPORT OF ANALYSIS a. Starting the ANSYS Report Generator b. Capturing Images for the Report c. Capturing Animations for the Report d. Capturing Data Tables for the Report e. Capturing Lists for the Report f. Compiling the Report g. Changing the Default Settings of the ANSYS Report Generator			
Total	**75**	**48**	

6. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, practical exercises and case studies.

7. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	Modeling for CAD / CAM Purpose	8	10
2	CNC Turning	10	15
3	CNC Milling	10	15
4	STAAD Pro Fundamentals	10	15
5	BASIC STATIC STRUCTURAL ANALYSIS USING ANSYS	10	20
	Total	48	75

8. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	Practical	Marks
1.	Simple truss modeling using STAAD.Pro	25
1	Application of loads using STAAD.Pro	25
2	Exercise in modeling for FEA using ANSYS	25
3	Post processing and result analysis using ANSYS s/w	25
4	Exercise on CAD Modeling for Milling a job	25
5	Exercise on CAD Modeling for turning a job	25
6	Milling a simple job on a CNC Machining Centre	25
7	Turning a simple job on CNC Turning Centre	25
8	Simple truss modeling using STAAD.Pro	25
	Average Total	25

9. LEARNING RESOURCESText

Books

S. No.	Author	Title of Books	Publishers
1	Satish Joshi	C.N.C. Vol 1 and Vol. II	Satish Joshi
2	P N Rao, N K Tewari, T K Kundra	Computer aided Manufacturing	Tata McGraw Hill
3	M. Adithan, B. S. Pabla	CNC Machines – Programming & Applications	Wiley Eastern Ltd,
4	Korem, Y. , J.B. Uri	Numerical Control of Manufacturing System	Mc Graw Hill
5	T.S. Sarma	Staad Pro V8i for Beginners	notionpress

Reference Books for further study

S. No.	Author	Title of Books	Publishers
1	Mikell P. Groover	Automation, Production systems, Computer integrated manufacturing	Pearson
2	Mikell P. Groover, Emory W. Zimmer	CAD/CAM Computer Aided Design And Manufacturing	Prentice Hall of India

Internet and Web Resources

S. No.	Author	Title of Books	Publishers
1	Autodesk	Help	Autodesk
2	ANSYS	Free Student Software | ANSYS Student	ANSYS

Videos and Multimedia Tutorials

S. No.	Author	Title of Books	Publishers
1	HTD	STAAD Pro Basic Tutorial for Beginners (Civil Engineering)	YouTube
2	TITANS of CNC: Academy	G & M Code - Titan Teaches Manual Programming on a CNC Machine.	YouTube
3	Tom Stikkelman	CNC mill programming	YouTube
4	Siemens	SINUMERIK Tutorial - programming with program GUIDE	YouTube
5	Siemens	SINUMERIK 808D Tutorial Turning	YouTube
6	CAE Worldwide	ANSYS Workbench Tutorial Video | Beginner/Expert | Contact Non Linear Frictional FE Analysis | GRS |	YouTube

(FB 712) MARKETING MANAGEMENT

1. COURSE OBJECTIVES

The knowledge gained by a student doing fabrication technology and erection engineering has helped many passed out students to become budding entrepreneurs. He gains the knowledge of various fabrication processes, besides the techniques of erection of heavy equipment and structures. Marketing a product needs additional knowledge of not only fabricating the conceptual model, but bringing it in the market and selling it. Product design itself is a vast topic. In this course, we will engage the student in study of fundamentals of product design and then marketing it.

2. TEACHING AND EXAMINATION SCHEME

Semester	**VII**								
Course code & course title		**Periods/Week (in hours)**			**Total Hours**	**Examination Scheme**			
						Theory Marks		**Practical Marks**	**Total Marks**
ME617 MARKETING MANAGEMENT		**L**	**T**	**P**	**H**	**TH**	**TM**	**TW**	**PR/OR**
		3	0	2	5	75	25	25	25	150

3. COURSE OUTCOMES:

On successful completion of the course, the student will be able to:
ME617.CO1. Find the various tactics used in marketing a product or services to stake holders. ME617.CO 2. Apply the principles of marketing management to enhance the market and sale of theproduct.
ME617.CO 3. Correlate the topics pertaining to product development to each other.ME617.CO 4. Modeling and testing a product based on market survey.

4. Mapping Course Outcomes with Program Outcomes

Relationship : Low-1 Medium-2 High-3

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific knowledge	**Problem Analysis**	Design & development of Solutions	**Engineering tools, Experimentation and practice**	Engineering practices for society , **sustainability and Environment**	Project Management	**Life-long learning**
CO 1	3	2	1	1	2	2	3
CO 2	2	2	3	2	2	2	2
CO 3	3	3	3	3	1	2	2
CO 4	3	2	3	2	2	2	2

	PSO1	PSO2
CO1	2	2

CO2	3	2
CO3	2	3
CO4	3	2

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	Thr = Teaching hours	CO = Course Objectives			
Unit			**M**	**Thr**	**CO**
1 FUNDAMENTALS OF MARKETING MANAGEMENT					
1.1.	Define: marketing, market and marketing management		15	10	CO1, CO2
1.2.	Explain simple model of marketing process				
1.3.	Understand various stakeholders of business: customers, employees, shareholders, society, government, suppliers, distributors, etc.				
1.4.	Marketing Management orientations:- Discuss :(a) production concept (b) the product concept (c) the selling concept (d) the marketing concept (e) the societal marketing concept				
1.5.	Building customer relationships: Definition of Customer relationship management (CRM), importance of CRM, customer value and customer satisfaction				
1.6.	Changing nature of customer relationship in modern times: discuss with examples				
1.7.	(a)selective relationship management (b) long term relationships (c)relating dire				
1.8.	Importance of ethics and social responsibility while marketing				
2 MARKET RESEARCH					

2.1	Marketing segmentation, Targeting, Positioning and Marketing Mix	15	8	CO1, CO2, CO4
2.2	Discussion on segmentation based on (a) geographic factors (b) demographic factors (c) psychographic factors (d) behavioral factors. Explain with real world examples.			
2.3	Definition of target marketing. Brief discussion on target marketing with examples.			
2.4	Understand the concept of Market Positioning with examples from corporate world			
2.5	Marketing Mix: discuss in detail, with examples, the four P's of marketing.			
2.6	Marketing Environment: discuss in detail, with examples, (a)Political environment, (b)economic environment, (c) social environment, (d) technological environment and (e) natural environment			
2.7	Marketing research			
2.8	Definition and scope of marketing research			
2.9	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			
3 CONSUMER BEHAVIOR, MARKETING CHANNELS, PRODUCT BRANDING, SERVICING			
3.1 Discuss, with examples or studies, factors influencing consumer behavior. Cultural factors, social factors, personal factors, psychological factors. 3.2 Discuss in detail, with examples — following types of buying decision behavior: (a) complex buying behavior (b) Dissonance reducing buying behavior (c) Habitual behavior (d) Variety seeking buying behavior 3.3 Business to Business Marketing (Industrial Marketing) 3.4 Define business markets and explain how business markets differ from consumer markets. 3.5 Discuss buying situations in industry- straight rebuy, new task, and modified rebuy. 3.6 Major influences on Business buyers 3.7 Difference between product and services 3.8 Classification of products: consumer products and industrial products 3.9 Product life cycle and various stages involved in it 3.10 Discuss in brief product and service decisions: product attributes, branding, packaging, and labeling and product support services. 3.11 Branding Strategy: Brief introduction to brand positioning, brand name selection, brand sponsorship and brand development. 3.12 The nature and importance of Marketing Channels 3.13 Number of Channel Levels: Understand levels in Direct Marketing Channels and Indirect marketing Channels 3.14 Understand Consumer marketing channels and Business marketing channels 3.15 Nature and importance of Marketing Logistics 3.16 Goals of Logistics system 3.17 Major Logistics Function: Warehousing, Inventory Management, Transportation, Logistics Information Management	15	10	CO2, CO3
4 SALES MANAGEMENT AND DIGITAL AGE MARKETING			

4.1	Discuss functions of salespeople: Prospecting, targeting, communicating, selling, servicing, information gathering, allocating.	15	10	CO3, CO4
4.2	Understand in detail various steps in selling process: Prospecting and qualifying, pre-approach, approach, presentation and demonstration, handling objections, closing, follow-up			
4.3	-Direct Marketing:			
4.4	Definition and concept of direct marketing			
4.5	Benefits and growth of direct marketing			
4.6	Use of customer database in direct marketing			

4.7	Forms of direct marketing: telephone marketing, direct mail market catalog			
4.8	marketing, direct response television marketing, kiosk marketing			
4.9	Ethical issues in direct marketing:			
4.10	(a) Irritation, unfairness, deception and frauds.			
4.11	(b) Invasion of privacy, etc.			
4.12	Brief discussion on major force shaping the digital age: digital limitations and connectivity, the explosion of the internet, new types of intermediaries, customization, etc.			
4.13	Definition of E-business, E-commerce and E-marketing			
4.14	Understand benefits of E-commerce to the buyers			
4.15	Understand benefits of E-commerce to the sellers			
4.16	E-marketing domains (discuss each domain with examples) a. Business- to- Consumer (B2C) b. Business-to- Business (B2B) c. Consumer —to- Consumer (C2C) d. Consumer —to — business (C2B)			
4.17	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.			
4.18	Discuss about Setting up an E-marketing presence: creating a website, online advertising, creating or participating in web communities, using email			
4.19	Discuss the promise, challenges and issues in E-commerce			
4.20	Mobile Commerce (M-Commerce): Concept of M-Commerce, Market size of M-commerce			
4.21	Examples of successful M commerce businesses,			
4.22	Latest trends in digital marketing Introduction			
5 Product Design, CAD/CAM, 3D Printing introduction				

5.1 5.2 5.3 5.4 5.5 5.6 5.7 5.8 5.9 5.10 5.11	Product Design: Design definitions and Design Spectrum, Ergonomics of design. Drawing and methods of presentation Elements of Design: An introduction to basic elements: Line, texture, colour, form, symmetry, balance, scale, mass, unity and variety. Concept of visual language and visual design. Introduction to Gestalt laws, composition and figure and ground relationships. Introduction to concept of negative space. Use of symmetry. Generation of patterns and textures using simple elements. Introduction to typography and fonts. Use of grids in graphic composition.	15	10	CO3, CO4

5.12	Colour circle, colour combinations and its dimensions: hue, value and Chroma.			
5.13	Colour meanings in traditions and psychological use of colours			
5.14	Product Attributes – Function and Emotion			
5.15	Product configurations and Component relationships (component Matrix)			
5.16	Understanding modularity and modular			
5.17	Systems – 3D lattice and structures			
5.18	Design of Modular System – abstract design			
5.19	Process of conception and its documentation			
5.20	Exposure to user experience design, green design, etc.			
5.21	Properties and usage of thermoplastics, thermosetting plastics. Process of selection and applications of plastics for engineering and consumer products.			
5.22	Design limitations and specific advantages of plastic molding processes.			
5.23	Assembly and Decorative techniques for plastic product			
5.24	Manufacturing processes and assembly techniques for Ferrous and nonferrous metals.			
5.25	Concepts of structure and costing.			
5.26	Significance of form in structural strength of products.			
5.27	Influence of materials and processes on product aesthetics.			
5.28	Industrial finishes for plastic, wood and metals.			
5.29	Properties and use of rubber, ceramics and glass.			
5.30	Properties of natural materials like wood, bamboo, cane, leather, cloth, jute and paper and their use at craft and industrial levels.			
5.31	Introduction to use of CAD/CAM/CNC/CAE and 3D printing			
Total		**75**	**48**	

6. COURSE DELIVERY:

The course will be delivered through lectures, class room interactions, and practical sessions

7. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	Fundamentals of marketing management	10	15
2	Market research	8	15
3	Consumer behavior, marketing channels, product branding, servicing	10	15
4	Sales management and digital age marketing	10	15
5	Product Design, CAD/CAM, 3D Printing introduction	10	15
	Total	48	75

8. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	Practical	Marks
1.	Visit a Marketing department of a business firm. Prepare a report on resources available at the above firm. List out the roles of various staff from the firm. What products are they marketing?	25
1	Simple Product design using ergonomics	25
2	Simple product design using aesthetics principles	25
3	3 D Printing of simple objects	25
4	Exercise on marketing portals for sales, purchase of products	25
5	Advertisement of products using multimedia tools	25
6	Case study of purchase procedure of any one category of products using GeM or other tools	25
7	Visit a Marketing department of a business firm. Prepare a report on resources available at the above firm. List out the roles of various staff from the firm. What products are they marketing?	25
	Total Average	25

9. LEARNING RESOURCESText

Books

S. No.	Author	Title of Books	Publishers
1	Philip Kotler, Kevin Keller	Marketing Management	Prentice Hall
2	J. C. Gandhi	Marketing- a managerial introduction	Tata McGraw Hill
3	R. S. Davar	Modern Marketing Management	Progressive Corporation Pvt. Ltd
4	Philip-Kotler	Marketing Management	Prentice India Ltd.
5	Alexander	Industrial Marketing	Cross & Still-D. B. Taraporewala Pvt. 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 Traveler Book Seller, Delhi

Reference Books for further study

S. No.	Author	Title of Books	Publishers
1	James Garratt	Design and Technology	Cambridge, USA
2	Samuel N. Bernier Samuel Nelson Bernier	Make: Design for 3D printing	Shroff Publishers & Distributors Pvt. Ltd.
3	Ben Redwood, Filemon Schöffer, Brian Garret, Tony Fadell	The 3D printing handbook	3D Hubs ISBN 9082748509, 9789082748505

Internet and Web Resources

S. No.	Author	Title of Books	Publishers
1	*Porter, Michael*	*Competitive Advantage (revised ed.).*	Oxford University Press, New Delhi1. (1998). The Free Press. ISBN 0-684-84146-0.
2	Joshi, Rakesh Mohan, (2005)	*International Marketing*,	New York ISBN 0-19-567123-6
3	Kotler, P. and Keller, K.L.	*Marketing Management*, 12th ed	Pearson, 2006, ISBN 0-13-145757-8
4	Wiki	*Marketing Management*	Wikipedia
5	Wiki	*Product Design*	Wikipedia

Videos and Multimedia Tutorials

S. No.	Author	Title of Books	Publishers
1	Chicago Humanities Festival	Philip Kotler: Marketing	Youtube
2	Dr Vivek Bindra	Secret Formula of Sales and Marketing Consumer Behaviour	Youtube Dr. Vivek Bindra: Motivational Speaker

(FB 713) PIPING FABRICATION & INSTALLATION

1. COURSE OBJECTIVES

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 includes study of piping materials and components, piping design, piping drawings and fabrication, essentially required for the layout, fabrication and installation/ laying of pipelines and considerations like pipeline inspection and testing, piping insulations, pipeline installation and special design considerations.

2. TEACHING AND EXAMINATION SCHEME

Semester	**VII**								
Course code & course title		**Periods/Week (in hours)**			**Total Hours**	**Examination Scheme**			
						Theory Marks		**Practical Marks**		**Total Marks**
FE 611 PIPING FABRICATION & INSTALLATION		**L**	**T**	**P**	**H**	**TH**	**TM**	**TW**	**PR/OR**	
		3	0	2	5	75	25	25	25	150

3. COURSE OUTCOMES:

On successful completion of the course, the student will be

able to:FE611.CO1.Understand basics of piping system

FE611.CO2.Apply piping knowledge for welding & fabrication of pipes and installation & testing of pipelines

FE611.CO3.Design a pipeline for a particular applicationFE611.CO4.Prepare piping drawings & bill of materials

4. Mapping Course Outcomes with Program Outcomes

Relationship : Low-1 Medium-2 High-3

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific knowledge	Problem Analysis	Design & development of Solutions	Engineering tools, Experimentation and practice	Engineering practices for society , sustainability and Environment	Project Management	Life-long learning
CO 1	3	1	1	1	1	1	1
CO 2	3	3	3	3	1	1	1
CO 3	3	3	3	3	1	1	1
CO 4	3	3	3	3	3	1	1

	PSO1	PSO2
CO1	3	1
CO2	3	3
CO3	3	3
CO4	3	3

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	**Thr = Teaching hours**	**CO = Course Objectives**		
Unit			**M**	**Thr**	**CO**
1 PIPING SYSTEM					
1.1 Introduction to Pipes and Pipelines a) Types of pipe lines : process piping & cross country pipeline b) Piping specification: Material, Nominal Bore, Schedule of Pipe (Class/Grade) c) Process Flow Diagram(PFD) & Piping & Instrumentation Diagram (P&ID)			6	4	CO1
1.2 Pipe Manufacturing Processes a) Seam pipes-continuous rolling, straight rolling, spiral rolling b) seamless pipes- Hot rolling, Extrusion, Casting			6	4	CO1
1.3 Cladding of pipes. Glass lining of pipes			3	1	CO1
2 PIPING DESIGN					
2.1 Data required for piping design. Use of corrosion table to select pipe material.			3	2	CO1 CO3
2.2 Effect of velocity of flow with change in pipe size. Relaxations of pressure drop of fluid in relation to pipe size & velocity of flow. Importance of velocity of flow. Effect of yield stress on pipes with temperature rise			4	3	CO1 CO3
2.3 Design procedure. Solving Numerical example			12	7	CO1 CO3
2.4 Special design considerations for steam piping, water piping, compressed air piping & gas piping.			3	2	CO1 CO3
3 PIPING DRAWING					
3.1 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			8	6	CO1 CO4
3.2 Preparing Bill of Materials			4	2	CO1 CO4
4 PIPE WELDING & FABRICATION					
4.1 Activities in Fabrication of Pipelines. Piping edge preparation. Importance of GTAW process for root run for high quality piping. Stove pipe technique for cross country pipelines.			4	3	CO1 CO2

4.2 Bending of Pipes: (i) Cold bending - Draw pipe bends. Compression	4	3	CO1

pipe bend, 3 point bend & Roll bend. (ii) Hot bending - Bending of pipe on a steel plate bed.			CO2
4.3 Fabrication of pipe bends by cutting & welding -2 pieces, 3 pieces, 4-pieces. Min length of pipe required for above bends. Solving Numerical examples.	4	4	CO1 CO2
4.4 End profile of pipe piece. Hole and End profile for Tee and Y branching.	4	1	CO1 CO2
4.5 Insulations: Definition, Classification & Types, Objectives, Procedure to apply Insulation on pipes.	4	2	CO1 CO2
5 PIPING INSTALLATION & TESTING			
5.1 Underground installation. Subsea installation: S-lay, J-lay.	3	2	CO1 CO2
5.2 Inspection and Testing - Hydro test	3	2	CO1 CO2
Total	**75**	**48**	

6. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies

7. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	PIPING SYSTEM	9	15
2	PIPING DESIGN	14	22
3	PIPING DRAWING	8	12
4	PIPE WELDING & FABRICATION	13	20
5	PIPING INSTALLATION & TESTING	4	8
	Total	48	75

8. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	Practical	Marks
1.	Practical Title	
1	Piping symbols & abbreviations	10
2	Pipe fittings & valves	
3	Process Flow Diagram and Piping & Instrumentation Diagram	
4	Equipment Layout Diagram	
5	Piping drawing from Isometric view to Orthographic view	10
6	Piping drawing from orthographic view to Isometric view	
7	Piping drawing from Plan elevation level to Isometric View	
8	Drawing developed view	
9	Preparing Bill of Material	
10	End profile of straight cut pipe	5
11	Hole profile for header pipe & End pipe profile of branch pipe for various branches like Tee, Y, etc	

	Total	25

9. LEARNING RESOURCESText

Books

S. No.	Author	Title of Books	Publishers
1	Nayyar	Piping handbook	Mc Graw Hill Book Company
2	Weaver	Process piping Designs Vol-I & Vol-II	-------
3	Weaver	Process piping drafting	-------
4	Sherwood	Piping guide	-------
5	Lindsey	Pipefitters Handbook	-------
6	Rampaul	Pipe welding procedures	-------

(FB 714) OFF SHORE STRUCTURES

1. COURSE OBJECTIVES

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, types 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

Semester VII									
Course code & course title	Periods/Week (in hours)			Total Hours	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
FE614 OFF SHORE STRUCTURES	L	T	P	H	TH	TM	TW	PR/OR	
	3	0	2	5	75	25	25	25	150

3. COURSE OUTCOMES:

On successful completion of the course, the student will be able to:
FE614.CO1. State the different types of off shore structures, buoyancy principles, materials and methodsof fabrication in marine environment.
FE614.CO 2. Understand the ocean environment, installation of pipelines process underwater FE614.CO 3. Choose appropriate method for laying pipelines and for erection of off shore structuresFE614.CO 4. Undertake repair and maintenance work underwater

4. Mapping Course Outcomes with Program Outcomes

Relationship : Low-1 Medium-2 High-3

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific knowledge	Problem Analysis	Design & development of Solutions	Engineering tools, Experimentation and practice	Engineering practices for society , sustainability and Environment	Project Management	Life-long learning
CO 1	2	1	1	1	-	-	-
CO 2	1	2	2	1	-	2	2
CO 3	1	2	2	1	-	2	1
CO 4	1	2	1	1	2	1	2

	PSO1	PSO2
CO1	1	1
CO2	1	2
CO3	1	2
CO4	1	2

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	**Thr = Teaching hours**	**CO = Course Objectives**		
Unit		**M**	**Thr**	**CO**
1 OCEAN RESOURCES				
Minerals – poly metallic nodules, placer deposits, oil and gas, gas hydrates		4	2	CO1
2 OCEAN ENVIRONMENT				
Waves- wave height , wave period, wave direction, design wave height		8	5	CO2
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.				
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 .		16	12	CO3
4. SUBMARINES PIPELINES		8	5	
Installation methods- Lay barge method, reel barge method, tow method, pipeline trenching methods- Jetting method, mechanical cutting, fluidization method, plowing method.				CO3
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.		12	8	CO1
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.		12	8	CO4
7. CONSTRUCTION TECHNOLOGY				
Marine operations- cranes-barge-derrick barges-jack-up barge, launch barges: Installation of offshore structure- steel jackets- removal of jacket from barge lifting and launching – Installation of the sea floor; Driving 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 .		15	8	CO3, CO4
Total		**75**	**48**	-

6. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies

7. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	**OCEAN RESOURCES**	2	4
2	**OCEAN ENVIRONMENT**	5	8
3	**TYPES OF OFFSHORE STUCTURES INCLUDING BASIC DESIGN CRITERIA**	12	16
4	**SUBMARINES PIPELINES**	5	8
5	**EQUILIBRIUM OF FLOATING BODIES**	8	12
6	**MATERIALS AND FABRICATION IN MARINE ENVIRONMENT**	8	12
7	**CONSTRUCTION TECHNOLOGY**	8	15
	Total	48	75

8. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	Practical	Marks
1.	Rotary drilling rig and its components Power system- Hoisting system- Circulating system- Well- controlled equipment, Auxiliaries	
2	Preparing the layout drawings of different offshore platforms	
	Total	25

9. LEARNING RESOURCESText

Books

S. No.	Author	Title of Books	Publishers
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 Structure Engg-I	Gulf Publishing Co. Book Division, Houston, London, Paris, Tokyo.
3	F.L.L.B Carneiro	Offshore Structure 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:	Gulf Publishing

S. No.	Author	Title of Books	Publishers
		Design, fabrication, Installation.	Company, Honston, USA,345 p
8	Khurmi, R. S.1983	A textbook of Applied Mechanics	S. Chand & Company, New Delhi, 669p
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, 473 p

Internet and Web Resources

S. No.	Author	Title of Books	Publishers
1		Read Off Shore Structures- Design Construction and Maintenance	https://www.dailymotion.com
2		Fabrication Technology of Off Shore Structures	www.nssm.com
3		Guidelines for High Productivity Fabrication of Offshore Structures	https://www.twi-global.com

Videos and Multimedia Tutorials

S. No.	Author	Title of Books	Publishers
1	NPTEL	Ocean Engineering – Off shore Structures	https://nptec.ac.in

SEMESTER	COURSE CODE	NAME OF COURSE	TEACHING SCHEME				EXAMINATION SCHEME				Total Marks
							Theory		Practical		
			L	T	P	H	TH	TM	PR	TW	
EIGHTH	FB801	Fabrication Inplant Training-Phase II	(24 weeks)						100	100	GRADE
		Total									GRADE
L- Lecturers T – Tutorial P – Practical H-Hours TH – Theory Marks TM – Test Marks PR – Practical Marks TW- Term Work Marks											

(FB801) FABRICATION INPLANT TRAINING –Phase II

1. COURSE OBJECTIVES

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.

2. TEACHING AND EXAMINATION SCHEME

Semester V									
Course code & course title	Periods/Week (in hours)			Total Hours	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
	L	T	P	H	TH	TM	TW	PR/OR	
FB801 FABRICATION INPLANT TRAINING -II	0	0	0	0	0	0	100	100	200

3. COURSE OUTCOMES:

On successful completion of the course, the student will be able to:

FB801.CO1 .Understand the work culture prevalent in the industry

FB801.CO 2. Imbibe the work culture and the best industry practices and inculcate the principles whilecooperating and collaborating with industry personnel

FB801.CO 3. Documenting the industrial experiences and day to day functioning of the various industryfunctions & processes in the daily diary.

FB801.CO 4. Implement the industrial experience for better understanding of academic learning

4. Mapping Course Outcomes with Program Outcomes

	PO 1 Basic & Discipline Specific knowledge	PO 2 Problem Analysis	PO 3 Design & development of Solutions	PO 4 Engineering tools, Experimentation and practice	PO 5 Engineering practices for society , sustainability and Environment	PO 6 Project Management	PO 7 Life-long learning
CO1	2	2	1	1	1	3	2
CO2	2	2	1	1	2	3	2
CO3	1	1	1	1	1	2	2
CO4	2	2	1	1	1	2	2

Relationship : Low-1 Medium-2 High-3

	PSO1	PSO2
CO1	1	2
CO2	1	3
CO3	1	2

CO4	1	3

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

Students are required to study and have hands-on experience wherever possible in the following
areas (depending on availability):

1. Company Profile
2. Organizational Structure
3. Company Product Range
4. Manufacturing Facilities Available /Services provided
5. Plant / Facility Layout
6. Operations / Production Processes
7. Production Planning and Control
8. Detail study of Latest Equipment/ Technologies Used
9. Stores Functions
10. Material Handling Systems/ Equipments
11. Quality Management Systems / Functions
12. Maintenance and Repair Practices
13. Scrap disposal procedures being followed in the industry
14. Safety Practices / Safety Equipments
15. Utilities
16. Logistics
17. Sales and Marketing
18. Ethics, Statutory Rules and Regulations followed
19. Product Design and Development
20. Any other area specific to the Industry providing Training

6. COURSE DELIVERY:

The Course will be delivered through placement of the students in various industries

7. The Time allocation:

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

8. TERM WORK & PRACTICALS

Evaluation Scheme					
TW			**PR/OR**		**TOTAL Marks**
Industrial Mentor's assessment Marks	Institute Mentor's assessment Marks	Daily Dairy	Training Report Assessment	Seminar/Viva	
25	**25**	**50**	**50**	**50**	**GRADE**

Daily Dairy

The trainees should maintain a daily diary in the notebook provided by institution. It should contain a brief account of observations and activities performed everyday by the trainees to the satisfaction of the Industrymentor. It should be shown to the Industry mentor for assessment and counter signature should be obtainedat least once in a week.

Assessment

The assessment of progress should be done whenever the Institute mentor visits the industry. The trainees should deliver seminar and submit an interim report at the end of 11th week of the training to the Institute mentor. The interim report shall be written by referring the daily diary, which is maintained by the trainee. Later, the Institute mentor and Industry mentor shall assess the progress of student either independently or in consultation based on the performance & qualification factors suggested below:

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	
Quality 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				

Training Report

The 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 50 pages, preferably with figures, graphs or photographs.

Assessment of Training Report be based on Knowledge, Presentation, Quality of contents &

SketchesGuide line 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 Equipments/machine /tools encountered: sketches/ photographs, specifications, applications.
6. Production processes employed.
7. Safety measures observed
8. Specific areas of Interest/ Assignments/ Projects undertaken.
9. Experience gained
10. List of figures/graphs.
11. List of tables.
12. Acknowledgement.
13. References

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 shall assess the seminar presentation, for maximum of 50 marks.

Note:

9. SUGGESTED SPECIFICATION TABLE WITH MARKS & HOURS

Unit No	Name of the Unit	Teaching Hours	Marks
1	**PR/OR**	**22 weeks**	**100**
2	**TW**		**100**
	Total	**22 weeks**	**GRADE**

Note:

1. Student/s undergoing Industrial Training shall follow Rules and Regulations of the Industry.

2. Industrial Training will generally be organized and conducted in accordance with Industrial TrainingManual duly prescribed by the Board.

3.For Industrial training 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'

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

5. Note for trainees:- The attendance should not be less than 75% of 22 weeks of the training period(Working days only being considered).

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