

**CURRICULUM FOR
DIPLOMA IN
MEDICAL ELECTRONICS
ENGINEERING
SEM I, II, III, IV, V & VI**

PROGRAMME STRUCTURE

SET II

Semester - I

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

Semester - II

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

GN 101 COMMUNICATION SKILLS

1. RATIONALE

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

2. TEACHING AND EXAMINATION SCHEME

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

Minimum passing % : Practical 40%

Legends:

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

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

3. DETAILED COURSE CONTENTS

Unit 1 - Fundamental of Communication skills

Definition, components (message, sender, receiver, transmission medium and protocol), types (verbal & non-verbal, technological & non-technological, etc), importance of communication skills, effective communication skills (phatic stage, personal stage and intimate stage), barriers in effective communications (verbal, non-verbal), barriers while speaking, other barriers (individual's viewpoints, emotional block, etc.) methods of and hint to increase communication skills, body language.

Unit 2 – Presentation Skills

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

Unit 3 - Technical Reports, Letter Writing, CVs

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

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

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

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

Unit 4 - Soft Skills

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

Unit 5 - Language Workshop

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

1. Reading Skills:

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

2. Listening Skills:

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

3. Writing Skills:

- a) Students to write on any given topic
- b) Students to compose their own stories
- c) Students will be given a particulars situation i.e. accident, college gathering etc. and asked to write a report

4. Speaking Skills:

- a) Students to speak on any given topic
- b) Narrate a story written by them.

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

4. List of Experiments :

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

5. SUGGESTED LEARNING RESOURCES

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

GN 102 ENGINEERING MATHEMATICS- I

1. RATIONALE

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

2. TEACHING AND EXAMINATION SCHEME

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

Minimum passing % : Theory 40%

Legends:

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

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

3. DETAILED COURSE CONTENTS

<p>Unit 0 Fundamentals of algebraic mathematical operations</p> <ul style="list-style-type: none"> • Use of scientific calculator • Recall of algebraic operations & formulae • Solving of simultaneous equations with two variables
<p>Unit 1 Co-ordinate Geometry/ Analytic Geometry;</p> <p>Purposes/Applications of Co-ordinate Geometry. Coordinate systems. <i>Straight Line</i>-Distance between two points. Internal & external division of a line. Area of triangle. Slope of line. Angle between two lines. Various forms of equation of line-parallel to axis, point-slope form, slope intercept form, two point form, intercepts form & normal form. General equation of line. Distance of a point from a line. - Equations of circle, Equations of tangent & normal to circle.</p>

Unit 2 Trigonometry

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

Unit 3 Limits & Functions

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

Unit 4 Differential Calculus

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

Unit 5 Application of derivatives

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

4. SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)

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

5. SUGGESTED LEARNING RESOURCES

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

GN 103 APPLIED PHYSICS-I

1. RATIONALE:

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

2. TEACHING AND EXAMINATION SCHEME:

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

Minimum passing % : Theory 40%

Duration of Theory Paper: 3 Hrs.

Legends:

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

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

3. DETAILED COURSE CONTENTS

Unit 1 UNITS & DIMENSIONS

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

Unit 2 KINEMATICS

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

Unit 3 PROPERTIES OF MATTER

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

Unit 4 HEAT

Definition of specific heat and units of specific heat. Modes of transfer of heat transfer, Conduction, Convection and Radiation. Law of thermal conductivity. Definition of coefficient of thermal conductivity. Determination of coefficient of thermal conductivity of a good conductor
Statement of Charles's law, Boyle's law and Gay Lussac's law. Derivation of general gas equation.

Unit 5 ELECTROSTATICS

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

Unit 6 MAGNETISM

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

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

Triangle law of forces, parallelogram law of forces (expression only), graphical & analytical representation of force, resolution of forces, resolving force into rectangular components. Definition & concept of friction, types of friction, Force of friction, Laws of static friction, Coefficient of friction, angle of friction (expression only), angle of repose(only qualitative aspects)

OR

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

Energy Band structure of electronic material(conductor , semiconductor and insulator)
Definition of semiconductors, types of impurities added to the semiconductors, intrinsic and extrinsic semiconductors.
Types of semiconductors P- type and N- type, Structure of P- type and N- type, Extrinsic semiconductor using pure Si and Ge semiconductors.
Types of carriers; N- type and P- type
Process of recombination of carriers.
Formation of P-N junction and depletion region.

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

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

7A-Mechanical and allied branches

7BFor Electronics and allied branches

5. SUGGESTED LIST OF EXPERIMENTS

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

6. SUGGESTED LEARNING RESOURCES

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

GN 104 APPLIED CHEMISTRY

1. RATIONALE

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

2. TEACHING AND EXAMINATION SCHEME:

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

Minimum passing % : Theory 40%

Legends:

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

3. DETAILED COURSE CONTENTS

Unit 1 Atomic Structure and Chemical Bonding

Fundamental particles and their characteristics, Energy levels - definition, designation of energy levels, Bohr- Bury's laws for distribution of electrons in shells (1st three laws only), concept and shape of orbitals (s and p only), Quantum numbers-designation, definition, values, Aufbau and Pauli's Exclusion Principle, Hund's rule of maximum multiplicity, orbital electronic configuration of elements with atomic number 1 to 20, Lewis and Langmuir concept of stable configuration. Concept of electrovalent, covalent and co-ordinate bond, Formation, properties and examples of electrovalent compounds (NaCl, MgO, CaCl₂) covalent compounds (Cl₂, O₂, N₂, CO₂)and coordinate compounds (O₃, SO₂).

Unit 2 Electrochemistry

Arrhenius theory of electrolytic dissociation., Degree of Ionisation- definition, factors affecting degree of ionisation , Nature of solute and solvent, concentration of solution, and temperature, Strong and weak electrolytes - definition and examples, Concept of the terms involved in electrolysis –conductor, insulator, electrolyte, non-electrolyte, electrolysis, electrodes, electrolytic cell, cathode, anode and current density, electrochemical series-concept and significance. Mechanism of electrolysis, Ionisation, primary reactions at the cathode, activity series of cations, primary reactions at the anode, activity series of anions, electrolysis of i. Fused NaCl using carbon electrodes, ii. aqueous NaCl using platinum electrodes iii. aqueous CuSO₄ using platinum electrodes iv. aqueous CuSO₄, using copper electrodes);

UNIT 3 Water and its treatment

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

Unit 4 Corrosion and Its Control

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

Unit 5 Lubricants

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

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

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

5. SUGGESTED LIST OF EXPERIMENTS

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

6. SUGGESTED LIST OF ACTIVITIES

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

7. SUGGESTED LEARNING RESOURCES

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

GN 204 ENGINEERING DRAWING

1. RATIONALE:

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

2. TEACHING AND EXAMINATION SCHEME:

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

Minimum passing % : Theory 40% and Practical 40%

Duration of Theory Paper: 3 Hrs.

Legends:

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

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

3. DETAILED COURSE CONTENT

Unit 1 Introduction

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

Unit 2 Dimensioning techniques and standard conventions

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

Unit 3 Engineering Curves & Shapes

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

Unit 4 Orthographic projection

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

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

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

Unit 5 Section of solids

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

Unit 6 Development of lateral surfaces

- Concept and importance of surface development in the engineering field.
Methods of development of surfaces-Radial & Parallel line method.
Development of surfaces for the following right regular solids-
- Cylinder
- Prism
- Cone
- Pyramids
- Development of solids standing on its base & cut by a plane inclined to either VP/HP and perpendicular to the other is also included.
- *Practice problems on above with top & bottom of the solid is excluded*

Unit 7 Isometric Views

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

4. SUGGESTED SPECIFICATION TABLE WITH MARKS & HOURS

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

5. SUGGESTED LIST OF ACTIVITIES

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

6. SUGGESTED LEARNING RESOURCES

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

SEMESTER II

GN-105 - COMPUTER FUNDAMENTALS & APPLICATIONS

1. RATIONALE

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

2. TEACHING AND EXAMINATION SCHEME

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

Minimum passing % : Theory 40%

Legends:

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

3. DETAILED COURSE CONTENTS

UNIT 1 Computer Fundamentals

1. Introduction to Computer
2. History, Evaluation, Classification and Generations of computers
3. Organisation of the Computer System
4. Hardware
 - Input device, Memory or Storage Devices, Processing Unit, Output device, Scanner Printers.
5. Communication technology and evolution of communication mediums

6. Software

System software

Application Software

Shareware

Freeware

Open Source

7. Concept of Computer Viruses

Definition

Types

Preventive Measures

UNIT 2 Operating System

1. Introduction to operating system

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

2. Windows Operating System-

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

UNIT 3 Application Software

1. MS Word

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

2. MS Excel

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

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

3. MS Power Point

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

UNIT 4 The Internet

Networks, Advantages of networking, Types of networks.

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

Email

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

4. SUGGESTED LIST OF EXPERIMENTS

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

Directorate of Technical Education, Goa State

4	3	Load Windows operating system. Configure and load relevant device drivers
5	4	<p>Practice on Windows 95/98/2000 ;</p> <ul style="list-style-type: none"> o Starting Windows, Exploring the desktop, Arranging windows, My Computer, The start button, Creating Shortcuts, Practice on moving and sizing of windows o Study of file organization: creating, copying, moving, renaming and deleting o Practice on Windows Accessories- Notepad, Word Pad and Paint o Editing document & formatting text, Previewing and printing document/Image file o Practice on Windows Explorer o Recycle bin o Shutting down windows
6	4	<p>Practice on MS-Word ;</p> <ul style="list-style-type: none"> o Create and format document o Edit and Modify text- changing font size type and style o AutoText, AutoComplete, AutoCorrect, grammar and spellchecker, Find and replace of text o Open save and print a document o Insert, modify table o Insert graphics o Mail merge
7	5	<p>Practice on Microsoft Excel</p> <ul style="list-style-type: none"> o Create, save & format worksheet o Open and save worksheet file o Edit & modify data o Use formula and functions o Split windows and freeze pans o Data sort and security features o Create, edit, modify and print worksheet. o Create and edit charts
8	5	<p>Practice on PowerPoint</p> <ul style="list-style-type: none"> o Create, edit, insert, move, slides o Open and save presentation o Insert picture, audio slide layout, action button o Apply custom animation o Present slide show
9	6	<p>Practice on:</p> <ul style="list-style-type: none"> o Identification of type of Account. o Connecting to internet o Dial up access o Web browsing o Searching websites o Information searching o Email services o Creating email accounts & Receiving and sending mails

5. SUGGESTED LEARNING RESOURCES

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

GN 106 BASIC ENGINEERING SKILLS

1. Rationale:

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

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

2. Teaching And Examination Scheme

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

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

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

3. Detailed Course Contents

Unit 1: General Safety, Housekeeping, Fire Fighting & First Aid

Introduction to General Safety aspects of engineering workshop, meaning and importance of housekeeping, possible fire hazards, fire triangle, types of fire extinguishers – selection and use, basic knowledge of first aid with specific inputs on cuts, burns, electric shocks, artificial respiration, handling emergencies.

Unit 2: Fitting Workshop Practice

Introduction to the trade, Introduction to various hand Tools, Measuring and Marking Tools, cutting tools, Holding tools, Striking tools, Types of files and filing methods. Drill bits and drilling Processes, using portable and pillar drilling machine. Operations performed in fitting shop such as measuring, marking, chipping, filing, grinding, sawing, drilling tapping and deing. Use of spirit level and plumb bob.

Unit 3: Carpentry Workshop Practice

Introduction to the trade, types of wood and its characteristics, forms of wood, defects in timber and its identification, wood working hand tools, wood working processes. Different types of joints and their usage. Introduction to wood working machines- lathe , circular saw, band saw, wood planner, universal wood working machine.

Unit 4: Electrical Workshop Practice

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Brief introduction to power distribution, different hand tools used in electrical trade, different measuring instruments. Making of cable joints. Measurement of current, voltage, frequency and Power Consumption. Connecting and starting of Induction Motor. Changing of Direction of rotation of induction motor. Introduction to commonly used electrical Fittings (Domestic & Industrial). Reading of simple electrical drawings.

Unit 5: Basic Electronics Workshop Practice

Introduction to basic electronic components, Introduction to use of Multimeter in measuring voltage, current, resistance, capacitance. Checking of connectivity. Introduction to soldering process. Soldering Irons- Types and wattage. Reading of basic electronic circuits.

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

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

GN201 ENGINEERING MATHEMATICS- II

Directorate of Technical Education, Goa State

1. RATIONALE :

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

2. TEACHING AND EXAMINATION SCHEME :

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

Minimum passing % : Theory 40%

Duration of Theory Paper: 3 Hrs.

Legends:

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

3. DETAILED COURSE CONTENT :

<p>Unit 1 Determinants Determinants of the second order and third order, solutions of equations in two or three variables using Cramer's Rule</p>
<p>Unit 2 Binomial Theorem - Binomial Theorem for a rational index, general term of binomial expansion, middle term (s).</p>
<p>Unit 3 Mensuration - Volume and surface area of - Prism, pyramid, frustrum of a sphere, frustrum of pyramid, frustrum of cone, Area and volume by Simpsons Rule</p>
<p>Unit 4 Matrices Definition and Notations, Elements of Matrix, Types of matrices, Special matrices - Square, Diagonal, Row, Column, Scalar Unit, Zero or null, upper and lower triangular matrices, Symmetric, Skew symmetric matrices . Addition, Subtraction and multiplication of matrices, Inverse of matrix using Adjoint method only Application of matrices in solving simultaneous equations in 2 or 3 variable.</p>
<p>Unit 5 Integral Calculus Definition, fundamental properties. Methods of Integration - Integration by substitution, Integration by parts, Integration by partial fractions.. Definition of Definite Integral Properties of definite integrals, Application of integration, area under a plane curve, volume of revolution.(simple sums only)</p>
<p>Unit 6 Differential Equations</p>

Definition, order and degree of a differential equation, solutions of differential equations of first order and first degree-variable separable type only. Second order differential equation of type $d^2y/dx^2 = f(x)$ only, Application of differential equation in engineering problems

Unit 7 Statistics (Mechanical and Allied Engg. Branches)

. Measures of central tendency for grouped and ungrouped data - Mean, Median and Mode . Measures of dispersion for grouped and ungrouped data -range , mean deviation, standard deviation, variance and co-efficient of variation

OR

Unit 7 Complex Numbers. (Electronics engg and Allied branches)

Definitions, Argand diagrams , polar form of a complex number, Addition, Subtraction, Multiplication & Division of a complex number. Exponential and circular function, De-moivres theorem, roots of a complex number- Cube roots of unity, n th roots of unity, , hyperbolic functions

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

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

\$- for Mechanical and allied branches

- For Electronics and allied branches

5. SUGGESTED LEARNING RESOURCES :

S.No.	Author	Title of Books	Publication & Year
1.	Deshpande S.P,	Mathematics for Polytechnics	Griha Prakashan, Pune, 1996 or latest
2.	Grewa, I B.S;	Engineering Mathematics	Khanna Pub., New Delhi 1995 or latest
3.	Prasad, I.B.;	Engineering Mathematics	Khanna Pub., New Delhi 1997 or latest
4.	Wartiker P.N.,	Applied Mathematics	Griha Prakashan Pune, 1996 or latest

GN 202 APPLIED PHYSICS-II

1. RATIONALE:

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

2. TEACHING AND EXAMINATION SCHEME:

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

Minimum passing % : Theory 40% and Practical 40%

Duration of Theory Paper: 3 Hrs.

Legends:

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

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

3. DETAILED COURSE CONTENTS

<p>Unit 1 FORCE, WORK, POWER, AND ENERGY Definition of Force and its units. Types of Forces with example- Direct, Remote action e.g. Gravitational Force, Magnetic Force, Electric Force. Effect of Forces on body-External, Internal. Work-definition and units, Graphical Representation of workdone, Energy definition and units. Types of Mechanical Energies- K.E. & P.E. Law of Conservation of Energy, Total Energy, Power-definition and units, Power (Force X Velocity)</p>
<p>Unit 2 CURRENT ELECTRICITY Ohms law, General equation of Ohms law, Factors affecting resistance, specific resistance and units. Effect of temperature on resistance, Law of resistance in series and parallel. Internal resistance and EMF of the cell. Potential drop along a uniform wire. Principle of potentiometer. Comparison of EMF of a given cell by single cell method. Comparison of EMF of a given cell by sum and difference method. Use of meter bridge to determine the unknown resistance. Definition of Electric power and energy in d.c. circuit. Concept of Kilowatt hour, calculation of energy bills.</p>
<p>Unit 3 ELECTROMAGNETISM Electromagnetic Induction, Faraday's Laws of Electromagnetic Induction, Lenz's Law, Self Induction & Mutual Induction.</p>
<p>Unit 4 LOGIC GATES Introduction to Binary Number System, Concept of '0' and '1' in Binary System. Binary equivalent of Decimal numbers from 0 to 10 Logic Gates: 1. 'NOT' Gate , 2. 'OR' Gate 3. 'AND' Gate. NAND , NOR GATE Their Logic Representation & Truth Table</p>

Unit 5 SOUND

Definition and examples of Free and Forced Vibrations, Resonance. Determination of velocity of sound using Resonance Tube.
 Definition of Beats (No derivation), Beat frequency & application of Beats, Definition of Echo, Reverberation & Reverberation time, Sabine's Formula, Acoustical Planning of an Auditorium. Factors affecting Reverberation Time, Ultrasonic waves, Piezo Electric Effect, Applications of Ultrasonic waves.

Unit 6 CIRCULAR MOTION AND GRAVITATION

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

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

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

OR

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

V-I characteristics of P-N junction. Diode as a rectifier. Half wave rectifiers, working, input and output waveforms, percentage regulation, $((V_{NL} - V_{FL}) / V_{FL}) \times 100$
 Full wave rectifier with centre tap transformer, working, input and output waveforms, percentage regulation
 Bridge rectifier, working, input and output waveforms, percentage regulation

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

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

7A- for Mechanical and allied branches

7B- For Electronics and allied branches

4. LIST OF EXPERIMENTS

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

5. SUGGESTED LEARNING RESOURCES

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

GN203 ENVIRONMENTAL STUDIES

1. RATIONALE

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

2. TEACHING AND EXAMINATION SCHEME

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

Minimum passing %: Theory 40%

Duration of Theory Paper: 3 Hrs.

3. DETAILED COURSE CONTENT

Unit 1 Multidisciplinary Nature Of Environmental Studies.

Definition, scope and importance. Need for public awareness.

Unit 2 Natural Resources

Renewable and nonrenewable resources. Natural resources and associated problems.

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

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

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

Unit 3 Ecosystems.

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

Unit 4. Biodiversity And Its Conservation.

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

Unit 5. Environmental Pollution.

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

Unit 6. Social Issues And The Environment.

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

Unit 7. Human Population And The Environment.

Population growth, variation amongst nations. Population explosion – Family welfare programme. Environment and human health. Human rights. Value education. HIV / AIDS. Women and child welfare. Role of Information technology in environment and human health. Case studies.

Unit 8. Field Work.

Visit local area to document environment assets – river / forest / grassland / hill / mountain. Visit to a local polluted site – urban / rural / industrial / agricultural. Study of common plants, insects, birds. Study of simple ecosystems – ponds, river, hill slopes, etc. (field work equal to 6 lecture hours).

4. SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)

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

5. MANDATORY ACTIVITIES

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

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

6. SUGGESTED VIDEOS

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

7. SUGGESTED LEARNING RESOURCES

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

GN 205 ENGINEERING MATERIALS

1. RATIONALE:-

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

2. TEACHING AND EXAMINATION SCHEME:

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

Minimum passing % : Theory 40%

Duration of Theory Paper: 3 Hrs.

Legends:

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

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

3. COURSE CONTENTS

Unit 1 Introduction to Engineering Materials

Classification of Materials

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

Differences between Metals & non-metals.

Properties of Materials.

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

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

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

Unit 2 Ferrous & Non-Ferrous Metals & its Alloys

➤ Ferrous alloys.

- Low carbon steel, medium carbon steel, High carbon steel, their carbon percentage, properties & uses.
- Cast iron – Grey cast iron, white cast iron, spheroidal grey cast iron, their properties & uses.
- Alloy steels.
 - Constituents of alloy steels such as phosphorous sulphur, Silicon, Manganese and their effect on properties of materials.
 - Stainless steel, chromium – Nickel steel, Nickel-chromium-molybdenum steel, Nitriding steel, Manganese steel, its properties & uses.
- Tool steel – composition, HSS, High carbon steel, properties & uses.

➤ Non-ferrous Metals & alloys

- Aluminium – Properties & uses.
- Aluminium alloys – constituents of alloy & their effect on properties of metal
- Properties & uses of Duralumin, Y-alloy, Al-si alloy, Al-Zn-Mg alloys.
- Copper – Properties & uses.
- Copper alloys – Constituents of alloy & their effect on properties of metal.
- Properties & uses of Copper – Zinc alloys such as Muntz metal, manganese bronze, copper-Tin alloys such as Bronze, copper aluminium alloys such as aluminium bronzes.
- Properties & uses of lead & its alloys.

Unit 3 Non – Metallic materials

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

- Vulcanization process.
 - Glass
- Properties & uses of soda glass, Borosilicate glass, fibre glass.
- Glass wool – composition, properties & uses.
 - Introduction to composite materials. Classification diagram only.

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

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

List of these materials and their applications.

Unit 5 Construction Materials

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

4. SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)

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

Semester - III

Course code	Name of Course	TEACHING SCHEME in hours				EXAMINATION SCHEME				Total marks
		L	T	P	C	Theory Marks		Practical Marks		
						TH	TM	PR/OR	TW	
CS308	Basic Electronics Engg.	3	-	2	5	75	25	50(P)	25	175
CS309	Digital Electronics	3	-	2	5	75	25	50(P)	25	175
MX302	Basic Human Biology For Engineers -I	3		3	6	75	25		25	125
MX303	Medical Instruments-I	3	-	3	6	75	25	-	25	125
EN302	Comp. Aided PCB design	1	-	4	5			-	50	50
CS501	Entrepreneurship Development		-	2	2				50	50
Total		13		16	29	300	100	100	200	700

CS308 BASIC ELECTRONICS ENGINEERING.

1. RATIONALE:

This course will enable the students to understand the construction, working, characteristics and applications of various types of semiconductor components such as Zener diode, Transistor and FET's.

2. TEACHING AND EXAMINATION SCHEME:

Course Code & Course Title	Periods/ Week (In Hours)			Total Credit	Examination Scheme				Total Marks
					Theory Marks		Practical Marks		
CS308 BASIC ELECTRONICS ENGINEERING.	L	T	P	C	TH	TM	TW	PR/OR	175
	3	-	2	5	75	25	25	50	

Minimum passing % : Theory 40%

Duration of Theory Paper: 3 Hrs.

Legends:

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

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

3. Unit- I –Regulators and Filters

(10 hrs) (20 marks)

Zener Diode: Construction, operation, characteristics, breakdown mechanism and important specifications. Zener as a regulator, simple calculations.

Filters: Ripple voltage, ripple factor. C filter operation and comparison. (No calculations and numericals)

Unit- II – Transistors

(14 hrs) (20 marks)

BJT – Basic construction, NPN and PNP type, transistor action, current – relationship in a transistor, leakage currents. CE, CB and CC configurations, Transistor input and output characteristics in CE configuration. Alpha, Beta and the relation between them. Comparison between the configurations. Current and voltage ratings of transistor.

Unit- III –Field Effect Transistors

(14 hrs) (20 marks)

JFET: Structure, n and p channel JFET, operation characteristics and comparison with BJT(no numericals), important JFET parameters(r_d, μ and gm).

MOSFET: Structure, operation and characteristics of enhancement and depletion type MOSFET, comparison with JFET.

Unit- IV - Unit –VI Logic families and Memories (10 hrs) (15 marks)

Introduction to Logic IC families, parameters-fan in , fan out, propagation delay, power dissipation, noise immunity .

Concept of TTL , C-MOS (for NAND & NOR gate), & their comparison.

Introduction to Memories: Semiconductor memory and its types (RAM /ROM. PROM/EPROM/EE PROM,; definition & application), Static/Dynamic memories. Flash memories.

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

Unit No.	Unit	Teaching Hours / Semester	Marks
1	Filters and regulator	10	20
2	Transistor	14	20
3	FET	14	20
4	Logic families and memories	10	15

5. SUGGESTED LIST OF EXPERIMENTS (Any 8-10)

Sr. No.	LIST OF EXPERIMENTS
1	Plot the VI characteristics of zener diode
2	Zener diode as a voltage regulator
3	Calculation of ripple factor for full wave rectifier
4	Calculation of ripple factor for C filter using full wave rectifier
5	Obtain input transistor characteristics for CE config.
6	Obtain output transistor characteristics for CE config.
7	Obtain input transistor characteristics for CB config.
8	Obtain output transistor characteristics for CB config
9	To study the transistor as a switch
10	Plot VI characteristics of JFET

6. SUGGESTED LEARNING RESOURCES

Sr.No.	Author	Title	Publication and Year
1	Bhargava & others	Basic course in Electronics	Latest
2	Robert L. Boylestad	Electronic Devices and Circuit Theory	Latest
3	V.K. Mehta	Principles of Electronics Engineering	Latest

CS 309 DIGITAL ELECTRONICS

1. RATIONALE:

This course includes detailed study of digital circuits such as adders, subtractors, flip flops, counters, registers and memories. This course will enable the students to understand the structure of digital computers, peripheral and other digital devices.

2. TEACHING AND EXAMINATION SCHEME:

Course Code & Course Title	Periods/ Week (In Hours)			Total Credit	Examination Scheme				Total Marks
					Theory Marks		Practical Marks		
CS309 DIGITAL ELECTRONICS	L	T	P	C	TH	TM	TW	PR/OR	175
	3	-	2	5	75	25	25	50(P)	

Minimum passing % : Theory 40%

Duration of Theory Paper: 3 Hrs.

Legends:

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

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

3. Unit-I Number Systems

(7 hrs) (12 marks)

Digital and Analog Signals- Decimal, binary, hexadecimal number system, conversion from one system to another, BCD code, ASCII code, gray code.

2's complement binary addition and subtraction.

Unit-II Combinational circuits.

(14hrs) (21 marks)

Symbol, truth table of basic gates (OR, NOR, AND, NOT, XOR, XNOR)

Laws of Boolean algebra and simplification of Boolean expressions

Demorgans and Duality theorem

K-map techniques (upto 4 variables)

Implementation of NOT,OR and AND gates using Universal gates (NAND, NOR)

Half adder, Full adder, Half subtractor , Full subtractor.

4-bit parallel binary adder: block diagram and operation.

Block diagram and implementation using basic gates: Multiplexer (4 to 1), Demultiplexer (1 to 4),

Encoder (4 to 2), Decoder (2 to 4).

BCD to 7 segment decoder driver (common cathode).

Unit-III Flip Flop.

(8 hrs) (12 marks)

Symbol, truth table, operation and timing diagrams of RS F/F & clocked RS F/F (using NAND gates),

D F/F JK F/F,JK master slave F/F(no timing diagram), T F/F.

Unit-IV Registers & Counters.

(8 hrs) (21 marks)

4 bit shift Register- function and logic block diagram, timing diagrams with negative edge triggered D F/F (Serial in-parallel out, Serial in-serial out, parallel in-parallel out register, parallel in serial out shift register) ,concept of shift right shift left, Ring counter.

Counters (no design). – Asynchronous/ Synchronous 4 bit up counter & Asynchronous/ synchronous 4 bit Down Counter , decade (mod 10) counter (synchronous type) (timing diagrams with negative edge triggered)

Unit V-ADC & DAC

(7 hrs) (9 marks)

Types of ADC & DAC (no description)

Working of binary ladder DAC.

Successive approximation ADC(only).

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

Unit No.	Unit	Teaching Hours / Semester	Marks
1	Number Systems	7	12
2	Combinational Circuits	14	21
3	Flip flops	8	12
4	Registers and Counters	8	21
5	ADC and DAC	7	9

5. UGGESTED LIST OF EXPERIMENTS

Sr. No.	LIST OF EXPERIMENTS
1	Verification of logic gates and demorgans theorem.
2	NAND as universal gate
3	NOR as universal gate
4	Half adder and full adder
5	Half subtractor and full subtractor
6	MUX & D-MUX
7	Seven segment decoder common anode & common cathode
8	RS and JK F/F
9	Assemble and test shift register using IC 7495
10	Assemble and test decade counter (any one type)
11	Assemble and test DAC

6. SUGGESTED LEARNING RESOURCES

Sr.No.	Author	Title	Publication and Year
1	Malvino and Leach	Digital principal and applications	Latest
2	R.P. Jain	Modern Digital Electronics	Latest
3	Bartee	Digital Computer Fundamentals	Latest

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MX 302 BASIC HUMAN BIOLOGY FOR ENGINEERS-I

1. RATIONALE

In order to understand the interaction of medical equipment with the human body the students would have basic knowledge of various systems ,related organs, secreted fluids etc in the human body .The emphasis will be on location & function of organs & systems, electric signals produced in the body cells & medical technology.

2. TEACHING AND EXAMINATION SCHEME

Course Code & Course Title	Periods/Week (In Hours)			Total Credits	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
	L	T	P	C	TH	TEST	TW	PR/OR	
Basis Human Biology for Engineers-I	3	-	3	6	75	25	25	--	125

Minimum passing % :Theory 40%

Duration of Theory Paper: 3 Hrs.

Legends:

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

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

3. DETAILED COURSE CONTENTS

Unit 1.CELL PHYSIOLOGY

10hrs (15M)

Cell & its organelles- structure & functions, cell division, resting & action potential, types of tissues, tissue regeneration, anatomical terms of the body, the skeleton- types & its functions, disorders of cells & tissues

Unit 2. THE BODY & ITS CONSTITUENTS

7hrs (10M)

Survival needs of the body- communication, transport system, intake of raw materials & elimination of waste, protection & survival, introduction to the study of illness.

Unit 3. HEMATOLOGY

9hrs (15M)

Blood- composition & cellular content of blood, functions of blood, functions of different blood cells like RBC, WBC, Platelets, Blood group determination, various blood tests commonly performed- ESR, RBC, WBC & Platelet count.

Unit 4. CARDIOVASCULAR SYSTEM

13hrs(20M)

Anatomy of the heart, flow of the blood through the heart, blood supply to the heart, conducting system of the heart, cardiac cycle, cardiac output, properties of cardiac muscle, blood pressure, cardiac failure, myocardial infarction, cardiac arrhythmias, heart block.

Unit 5. RESPIRATORY SYSTEM 9Hrs (15M)

The organs of respiration- nose, pharynx, larynx, trachea, lungs, bronchi & bronchioles, process of respiration & breathing, muscles of breathing, cycle of breathing, exchange of gases, lung volumes & capacities.

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

Unit No.	Name if the Unit	Teaching Hours / Semester	Marks
1	CELL PHYSIOLOGY	10	15
2	THE BODY & ITS CONSTITUENTS	7	10
3	HEMMATOLOGY	09	15
4	CARDIOVASCULAR SYSTEM	13	20
5	RESPIRATORY SYSTEM	09	15

5. SUGGESTED LIST OF EXPERIMENTS

Sr. No.	LIST OF EXPERIMENTS
1	To study the use of compound microscope.
2	To calculate body mass index.
3	To study & mount cheek cell on microscope.
4	To determine bleeding & clotting time.
5	To count total RBC in human body.
6	To count total WBC in human body.
7	Blood group determination.

6. SUGGESTED LEARNING RESOURCES

Sr.No.	Author	Title	Publication and Year
1.	Waugh Grant	Anatomy & physiology in health and illness	Latest
2.	C.C. Chatterjee	Human Physiology Part I&II	Latest

MX 303 MEDICAL INSTRUMENTS-I

1. RATIONALE

This course describes the principles, applications & design of medical instruments most commonly used in the pathology & other department of any hospital. We lay stress on fundamentals, principles of operation & general types of equipments.

2. TEACHING AND EXAMINATION SCHEME

Course Code & Course Title	Periods/Week (In Hours)			Total Credits	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
	L	T	P	C	TH	TEST	TW	PR/OR	
Medical Instruments-I	3	-	3	6	75	25	25	--	125

Minimum passing % :Theory 40%

Duration of Theory Paper: 3 Hrs.

Legends:

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

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

3. DETAILED COURSE CONTENT

Unit 1. STUDY OF CRO

4hrs (8M)

CRO-Block diagram, operation of CRO, Digital Storage Oscilloscope- block diagram, operation.

Unit 2. BIOELECTRIC SIGNALS, ELECTRODES & SENSORS 7hrs (12M)

Origin of Bioelectric signals, recording electrodes, electrode tissue interface, polarization, skin contact impedance, motion artifacts, electrical conductivity of electrode jellies & creams, optical fiber sensors, biosensors.

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Unit 3. CLINICAL LABORATORY INSTRUMENTS 14hrs (20M)

Medical Diagnosis with chemical test, spectrophotometry, spectrophotometer type instruments, microprocessor controlled spectrophotometer, colorimeters, automated biochemical analysis system, clinical flame photometers, computers in clinical laboratory, sterilization & its agents.

Unit 4. BLOOD CELL COUNTERS 14hrs(20M)

Types of blood cells, methods of cell counting-microscopic method, automatic optical method, electrical conductivity method, coulter counters-multiparameter coulter counter, picoscale, automatic recognition & differential counting of cells-block diagram of cell identification system.

Unit 5. PULMONARY FUNCTION ANALYZER 9Hrs (15M)

Pulmonary function measurements, respiratory volumes & capacities, spirometry& its types, pneumotachometers, measurement of volume-flow volume curve, area of the flow volume, nitrogen washout technique.

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

Unit No.	Name if the Unit	Teaching Hours / Semester	Marks
1	STUDY OF CRO	4	08
2	BIOELECTRIC SIGNALS, ELECTRODES & SENSORS	7	12
3	CLINICAL LABORATORY INSTRUMENTS	14	20
4	BLOOD CELL COUNTERS	14	20
5	PULMONARY FUNCTION ANALYZER	9	15
	TOTAL	48	75

4. SUGGESTED LIST OF EXPERIMENTS

Sr. No.	LIST OF EXPERIMENTS
1	Basic guidelines in medical laboratory.
2	Rapid test for:- a) Malaria b) Dengue etc.
3	Estimation of blood glucose using glucometer.
4	Hemoglobin test by using Sahli's hemoglobinometer.
5	Blood pressure measurement by using Sphygmomanometer.
6	Lung volume measurement by using Spirometer.
7	Demonstration of the use of Colorimeter.
8	Field trip to a pathology lab to see the different updated instruments used in the lab.

5. SUGGESTED LEARNING RESOURCES

Sr.No.	Author	Title	Publication and Year
1.	R.S. Khandpur	Handbook of medical instruments	Latest
2.	Leslie Cromwell	Biomedical instrumentation & measurements	Latest
3.	John Webster	Medical instrumentation	Latest

EN 302 COMPUTER AIDED PCB DESIGN

1. RATIONALE:

PCB design is an important skill required by design as well as maintenance personnel in Industry. Electronic Design Automation tools widely being used in Industry for PCB design . This course will enable the student to design PCB for electronic circuits using CAD software.

2. TEACHING AND EXAMINATION SCHEME:

Course Code & Course Title	Periods/ Week (In Hours)			Total Credit	Examination Scheme				Total Marks
					Theory Marks		Practical Marks		
COMPUTER AIDED PCB DESIGN	L	T	P	C	TH	TM	TW	PR/OR	50
	1	-	4	5	-	-	50	-	

Minimum passing % :
Legends:

Duration of Theory Paper:

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

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

3. Unit- I – Basic of PCB

Introduction – Classification of PCB – single, double, multilayer and flexible boards – copper clad laminates materials of copper clad laminates – manufacturing process – properties of laminates (electrical & physical) - types of laminates.

Unit- III – Schematic & Layout Design

Schematic diagram – Net list – Design rule check – creating components for library – Imperial – metric Tracks – Pads – Vias – Clearances – Rats nest – silk screen – selection of board size – power plane – grounding

Unit- IV – Design of PCB’s

Single sided PCB – Double sided PCB – Multilayer PCB – Auto routing – manual routing – Design rule check – creating of foot print for library creating Gerber file.

Unit- V – PCB Fabrication

Film master preparation - Image transfer - photo printing – Screen Printing – Plating techniques etching techniques – Mechanical Machining operations.

4.SUGGESTED LIST OF EXPERIMENTS

Sr. No.	LIST OF EXERCISES
1	PCB design of Centre tap Rectifier
2	PCB design of Bridge Rectifier
3	PCB design of Transistor Amplifiers
4	PCB design of Operational Amplifiers
5	PCB design of Digital IC based circuits
6	Design of custom library components
7	Creation of Gerber files
8	PCB design of simple mini -project circuits
9	Fabrication of a PCB for a designed PCB layout

5. SUGGESTED LEARNING RESOURCES

Sr.No.	Author	Title	Publication and Year
1	Latest	Printed Circuit Board— Design, Fabrication, Assembly & Testing	Latest
2	Walter C.Bosshard	Printed circuit Board – Design & Technology	Latest
3	ISTE Hand book	Printed Circuit Board Fabrication.	

(CS501) Entrepreneurship Development

Unit 1:Introduction

(7 Hours, 12 Marks)

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

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

Unit 2:Forms of Business Organisation

(2 Hours, 9 Marks)

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

Unit 3:Entrepreneurial Support System

(6 Hours, 9 Marks)

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

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

Unit 4: Business Opportunity Identification

(7 Hours, 6 Marks)

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

Unit 5: Market Research

(6 Hours, 12 Marks)

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

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

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

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Unit 6: Legal Aspects

(4 Hours, 9 Marks)

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

Unit 7: Project Report

(16 Hours, 18 Marks)

Need for project report, importance of Project report,

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

List the contents of a project report.

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

Project Profile.

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

MANDATORY ASSIGNMENTS

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

SUGGESTED ACTIVITIES:

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

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Semester - IV

Course code	Name of Course	TEACHING SCHEME in hours				EXAMINATION SCHEME				Total marks
		L	T	P	C	Theory Marks		Practical Marks		
						TH	TM	PR/OR	TW	
MX401	ELECTRONIC DEVICES AND CIRCUITS	3	-	2	5	75	25		25	125
EN405	ANALOG ELECTRONICS	4	-	2	6	75	25	50	25	175
MX402	BASIC HUMAN BIOLOGY FOR ENGINEERS-II	3	-	2	5	75	25		25	125
MX403	MEDICAL INSTRUMENTS-II	3	-	2	5	75	25	50	25	175
EN403	CIRCUITS AND NETWORKS	4	-	2	6	75	25		25	125
MX404	PROGRAMMING OF 8051 MICROCONTROLLER IN C	2	-	3	5	-	-	50	50	100
Total		19	-	13	32	375	125	150	175	825

(MX401) ELECTRONIC DEVICES AND CIRCUITS

1. RATIONALE:

This course will enable the students to understand the applications of transistors and thyristors in the field of electronics.

2. TEACHING AND EXAMINATION SCHEME:

Course Code & Course Title	Periods/ Week (In Hours)				Total Credit	Examination Scheme			
						Theory Marks		Practical Marks	
Electronic devices and circuits	L	T	P	C	TH	TM	TW	PR/OR	125
	3	-	2	5	75	25	25	-	

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

Legends:

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

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

3. DETAILED COURSE CONTENTS

Unit-I	Transistor Biasing	(10 hrs) (12 marks)
a) Need for biasing transistors, Essentials of a Transistor Biasing Circuit b) Methods of Transistor Biasing- base bias circuit, voltage divider biasing circuit.		
Unit-II	Feedback in Amplifiers	(12 hrs) (18marks)
a) Concept of Positive and Negative feedback, Effect of negative feedback in amplifiers, b) Types of negative feedback in amplifiers (block diagram level only)-Voltage-series feedback, Voltage-shunt feedback, Current-series feedback, Current-shunt feedback. c) Study of Single Stage CE Amplifier- Graphical demonstration of CE Amplifier operation, Input/Output Phase relationships, Voltage Gain(with and without AC feedback), Frequency response (with and without feedback). d) Multistage Transistor Amplifiers- methods of coupling transistor amplifiers and their comparison.		
Unit-III	Oscillators	(08 hrs) (15marks)
a) Principle of an oscillatory circuit , undamped oscillations from a tank circuit b) Barkhausen criterion for oscillators, c) Tuned collector oscillator, Colpitt's oscillator, Hartley oscillator, applications of oscillators.		

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Unit-IV	Power Electronics(09 hrs) (15marks)	
a) Silicon-Controlled Rectifier (SCR)- construction and characteristics b) DIAC-construction and characteristics, c) TRIAC-construction and characteristics, d) Thyristor turn ON methods, e) UJT- construction, characteristics, UJT as a relaxation oscillator,		
Unit-V	Applications of Thyristors	(09 hrs) (15marks)
a) Single phase controlled rectifiers with resistive load (current and voltage waveforms , no mathematical treatment) , b) Single phase half wave and full wave controlled rectifiers with R-L load (current and voltage waveforms , no mathematical treatment), c) Single phase bridge type inverter (current and voltage waveforms , no mathematical treatment), e) Phase control circuit using Diac and Triac.		

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

Unit No.	Unit	Teaching Hours / Semester	Marks
1	Transistor Biasing	10	12
2	Feedback in Amplifiers	12	18
3	Oscillators	8	15
4	Power Electronics	09	15
5	Applications of Thyristors	09	15

Legends: R = Remembrance; U= Understanding; A= Application and above levels

5. SUGGESTED LIST OF EXPERIMENTS

Sr. No.	LIST OF EXPERIMENTS
1	Study of base bias circuit
2	Study of voltage divider bias circuit
3	Study of CE Amplifier without feedback
4	Study of feedback on CE Amplifier
5	Study of multi-stage Amplifier
6	Study of Colpitts Oscillator
7	Study of Hartley Oscillator
8	Study of UJT Relaxation Oscillator
9	Study of Single phase controlled rectifier
10	Study of Phase control circuit using Diac and Triac

6. SUGGESTED LEARNING RESOURCES

Sr.No.	Author	Title	Publication and Year
1.	V.K. Mehta	Principles Of Electronics	Latest
2.	N. N. Bhargava S. C. Gupta and D. C. Kulshreshtha	Basic Electronics and Linear Circuits	Latest
3.	M. H. Rashid	Power Electronics: Circuits, Devices, and Applications	Latest

(EN405) ANALOG ELECTRONICS

1. RATIONALE:

This course deals with the differential and operational amplifiers. The concept of feedback in operational amplifiers along with the application of operational amplifiers, active filter design, IC555 and fixed voltage regulators are also emphasized.

2. TEACHING AND EXAMINATION SCHEME:

Course Code & Course Title	Periods/ Week (In Hours)			Total Credit	Examination Scheme				Total Marks
					Theory Marks		Practical Marks		
Analog Electronics	L	T	P	C	TH	TM	TW	PR/O R	175
	4	-	2	6	75	25	25	50	

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

Legends:

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

Unit I: Differential Amplifier (02hrs) (05 marks)

Differential amplifier circuit and its operation.

Different modes of operation-dual input balanced output differential amplifier and dual input un- balanced output differential amplifier (no derivations)

Unit II: Operational Amplifier Basics (08 hrs) (15 marks)

Op-amp—Block diagram and its working, symbol and equivalent circuit of op-amp. Pin configuration of IC741.

Characteristics of ideal and practical Op-amp.

Op-amp Parameters(only definition)- I/p offset voltage, I/p offset current, I/p bias current, o/p offset voltage, input impedance, output impedance, bandwidth, CMRR, slew rate.

Unit III: Feed-back in Op-amps (06 hrs) (10 marks)

Voltage series feedback amplifier- block diagram, circuit diagram, expression for voltage gain.

Voltage shunt feedback amplifier- block diagram, circuit diagram, expression for voltage gain.

Unit IV: Basic applications of Op-amps (10 hrs) (15 marks)

Inverting Op-amp as summing, scaling, averaging amplifier and subtractor. Voltage to current and Current to voltage convertor.

Integrator and differentiator.

Voltage comparators, Schmitt trigger circuit, Sample and hold circuit, peak detection using op-amp.

Unit V: Active Filters (06 hrs) (10 marks)

Concepts of active filters, comparison of active & passive filters. Butter worth low pass and high pass filter (1st order only), simple numerical problems on above filters.

Unit VI: Waveform Generation (08hrs) (10 marks)

Op-amp Wein bridge oscillator, Op-amp as Astable multivibrator and triangular waveform generator.

Block diagram of IC 555 and its pin configuration, IC555 as Astable and monostable multivibrator (numerical problems)(no derivations).

Unit VII: Voltage Regulators (08 hrs) (10 marks)

Circuit diagram and working of an Op-amp series voltage regulator.

Performance parameters of a regulator – load & line regulation and ripple rejection.

Salient features of three pin regulators, IC78XX series and IC79XX series fixed voltage regulators.

IC723 as a low voltage and high voltage regulator (numerical problems).

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

Unit No.	Unit	Teaching Hours / Semester	Marks
1	Differential Amplifier	2	5
2	Operational Amplifier Basics	8	15
3	Feed-back in Op-amps	6	10
4	Basic applications of Op-amps	10	15
5	Active Filters	6	10
6	Waveform Generation	8	10
7	Voltage Regulators	8	10

Legends: R = Remembrance; U= Understanding; A= Application and above level

4. SUGGESTED LIST OF EXPERIMENTS

Sr. No.	LIST OF EXPERIMENTS
1	Determination of Op-amp (IC741) parameters
2	Inverting and non-inverting Op-amp amplifier
3	Op-amp as adder, subtractor and averager
4	Op-amp as voltage comparator
5	Op-amp as integrator and differentiator
6	Op-amp wein bridge oscillator
7	Op-amp as astablemultivibrator
8	IC fixed voltage regulators
9	IC 555 as astable/monostablemultivibrator
10	Op-amp as low pass and high pass filter

5. SUGGESTED LEARNING RESOURCES

Sr.No.	Author	Title	Publication and Year
1.	Gayakwad, R.A.	Op-amps and linear ICs	Latest
2.	Botkar,K.R.	Op-amps and linear Integrated circuits	Latest

(MX402) BASIC HUMAN BIOLOGY FOR ENGINEERS-II

1. RATIONALE

In order to understand the interaction of the medical equipment with the human body, the students should have basic knowledge of various systems, related organs, secreted fluids, etc. This course covers anatomy and physiology of the human body. The emphasis will be on the location, functions of various systems and organs. Biopotential developments, various body fluids and their normal composition and the medical terminology.

2. TEACHING AND EXAMINATION SCHEME

Course Code & Course Title	Periods/Week (In Hours)			Total Credits C	Examination Scheme				Total Marks
					Theory Marks		Practical Marks		
	L	T	P		TH	TEST	PR/OR	TW	
Basic Human Biology For Engineers-II	3	-	3	6	75	25	--	25	125

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

Legends:

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

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

3. DETAILED COURSE CONTENTS

Unit 1.NERVOUS SYSTEM	14hrs (20M)
Functional components of nervous system, Neurons-different parts of neurons, properties of neurons, the nerve impulse (action potential), types of nerves, The synapse C (neuro transmitters , central nervous system- Cerebraspinal fluid (CSF), brain –different parts & their functions spinal cord-structure & different parts & their functions, spinal cord- structure & different matters present in spinal cord & their functions	
Unit 2. THE SPECIAL SENSES	14hrs (20M)
The ear & hearing- Structure of ear, physiology of hearing, sight & the eye- Structure of eye, physiology of sight, Instrument Test of hearing, Deafness & hearing aids. Refractive errors of the eye, instruments- ophthalmoscope, retinoscopy, keratometer, lensometer, tonometers. Accessory organs of the eye & their functions.	
Unit 3.THE EXCRETORY SYSTEM	14hrs (20M)
Kidneys- Gross structure of the kidney, functions of the kidney-formation of urine, filtration, selective re- absorption, Tubular secretion, summary of urine formation, structure & functions of ureters, urinary bladder, urethra.	
Unit 4.SKELETAL SYSTEM	06hrs(15M)
Bone-functions & structure of Bone, healing of bone, factors that delay healing of fractures, complication of fractures, functions of the skull, vertebral column, Thoracic cage- sternum(breast bone), Ribs.	

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

Unit No.	Name if the Unit	Teaching Hours / Semester	Marks
1	NERVOUS SYSTEM	14	20
2	THE SPECIAL SENSES	14	20
3	THE EXCRETORY SYSTEM	14	20
4	SKELETAL SYSTEM	06	15

5. SUGGESTED LIST OF EXPERIMENTS

Sr. No.	LIST OF EXPERIMENTS
	The students will study the specimens of the following systems & organs.
1	Neuron
2	Human brain
3	Spinal Cord
4	Eye
5	Ear
6	Kidney & the excretory system.
	They will also do the following:-
7	Testing of visual activity by Shellen's Charts
8	Testing for colour blindness using Ishihara Charts
9	Rinne's Test
10	Weber's Test

Mini Project

The student will have to do a small Project in biological techniques on any topic in the syllabus. The project could involve making charts, models etc.

6. SUGGESTED LEARNING RESOURCES

Sr.No.	Author	Title	Publication and Year
1.	Waugh Grant	Anatomy & physiology in health and illness	Latest
2.	C.C. Chatterjee	Human Physiology Part I&II	Latest

(MX403) MEDICAL INSTRUMENTS-II

1. RATIONALE

Transducers & recorders are important components of Medical instruments. Students undergoing this course will learn about various biomedical & physiological transducers & recorders. The students have been exposed to electrodes in Medical Instrument-I, therefore this course explores physiological transducers, Biomedical recorders & blood flow meters.

2. TEACHING AND EXAMINATION SCHEME

Course Code & Course Title	Periods/Week (In Hours)			Total Credits	Examination Scheme				Total Marks	
	L	T	P		C	Theory Marks		Practical Marks		
						TH	TEST	PR/OR		TW
Medical Instruments-II	3	-	2	5	75	25	--	25	125	

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

Legends:

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

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

3. DETAILED COURSE CONTENTS

Unit 1. PHYSIOLOGICAL TRANSDUCERS	12hrs (20M)
Introduction, classification of transducers, Displacement, position & motion transducers-potentiometric transducers, variable capacitance, inductance, linear variable, Differential Transformer (LVDT) , piezo electric transducers, Pressure Transducers, LVDT pressure transducer, strain gauge pressure transducers, Transducers for Body temperature measurement-Thermocouples, Electrical Resistance Thermometer, Thermistors, Photoelectric transducers-photovoltaic or Barrier layer cells, photoemissive cells.	
Unit 2. BIOMEDICAL RECORDERS	16hrs (25M)
Basic recording system, electrocardiograph (ECG), Block diagram of ECG, The ECG leads, effects co artefacts on ECG recordings, Microprocessor based ECG machines, multichannel ECG machine, Phonocardiograph(PCG), Electroencephalograph (EEG)-Block diagram, electrode placement, evoked potentials, Electromyograph (EMG), other biomedical recorders-Apex cardiograph, Ballisto cardiograph, (BCG) electrooculograph (EOG), Electroretinograph (ERG)	
Unit 3. AUDIOMETERS & HEARING AIDS.	10hrs (15M)
Mechanism of hearing, Air & bone conduction, measurement of sound, Transducers, Basic audiometer-General requirements of audiometers, masking in audiometry, pure toneaudiometer, speech audiometer, evoked response audiometry system, calibration of audiometers, hearing aids- conventional hearing aid, Digital hearing aid, cochlear implants.	
Unit 4.MEASUREMENT OF BLOOD FLOW & CARDIAC OUTPUT	10hrs(15M)
Oximetry in brief, types of blood flow meters-electromagnetic, ultrasound, bloodflow determination by radiographic methods, plethysmography, cardiac O/P measurement-indicator dilution method, Dye dilution method, ultrasound method.	

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

Unit No.	Name if the Unit	Teaching Hours / Semester	Marks
1	PHYSIOLOGICAL TRANSDUCERS	12	20
2	BIOMEDICAL RECORDERS	16	25
3	AUDIOMETERS & HEARING AIDS	10	15
4	MEASUREMENT OF BLOOD FLOW & CARDIAC OUTPUT	10	15

5. SUGGESTED LIST OF EXPERIMENTS

Sr. No.	LIST OF EXPERIMENTS
1	Temperature measurement by Thermister & Resistance Temperature Detector.
2	Displacement Measurement using a LVDT
3	Stress & Strain measurement by Strain Gauge.
4	Intensity measurement using a Light Dependent Resistor.
5	Study of Electrocardiogram & Electrocardiograph Machine.
6	Study of EEG
7	Study of Audiometers
8	Study of Hearing Aids

6. SUGGESTED LEARNING RESOURCES

Sr.No.	Author	Title	Publication and Year
1.	R.S. Khandpur	Handbook of medical instruments	Latest
2.	Leslie Cromwell	Biomedical instrumentation & measurements	Latest
3.	John Webster	Medical instrumentation	Latest

(EN403) CIRCUITS AND NETWORKS

1. RATIONALE:

This course is classified under basic technology group and is intended to enable the student understand the concepts and principles of the electrical and electronics engg. circuits and how to analyze them.

2. TEACHING AND EXAMINATION SCHEME:

Course Code & Course Title	Periods/ Week (In Hours)			Total Credit	Examination Scheme				Total Marks
					Theory Marks		Practical Marks		
	L	T	P	C	TH	TM	TW	PR/OR	
CIRCUITS AND NETWORKS	4	-	2	6	75	25	25	-	125

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

Legends:

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

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

Unit-I Basic Terminology (9 hrs) (9 marks)

Definition of circuit, network, voltage, current, power

Mesh, loop, node, branch, active & passive elements. Linear & nonlinear, lateral & bilateral (definitions only).

Lumped and distributed parameters.

Voltage & current sources (ideal and practical).

Series and parallel equivalent expressions of resistors, capacitors and inductors (derivations not included).

Current & voltage divider Theorem (problems based on it).

Unit II- DC Network Theorems. (19 hrs) (27marks)

Kirchoff's Voltage and Current laws.

Reduction methods, Mesh analysis, Nodal Analysis, Superposition Theorem, Thevenin's theorem, Maximum power transfer theorem.

Star-Delta transformation.

(Statements and problems on all the above)

Unit III- AC Circuits. (12 hrs) (15 marks)

Response of R, L and C to ac signals (no derivations)

Series Resonance circuits : Series RLC circuit, resonant frequency, graphical representation of resonance, Resonance curve, half-power bandwidth of a resonant circuit, Q-factor. (No derivations)

Simple problems for calculation of I_o , f_o , BW, f_1 , f_2 , Q, Z.

RC-Integrator, RC- differentiator. (Sine and square wave inputs only)

Unit-IV Networks (12 hrs) (12 marks)

Networks: Characteristic impedance, short circuit & open circuit impedance, Propagation constant,

Attenuation & phase constant, Image & iterative impedance

Symmetrical T, π networks

Derivation for only T network- Z_o , Z_{oc} , Z_{sc} , γ , Z_1 , Z_2 (Simple numericals)

Unit-V Filters and Attenuators (12 hrs) (12 marks)

Filters-LPF, BPF, HPF, BRN (graphical interpretation), Constant k (LPF, HPF-T type only)- Design formulae & numerical.

Attenuator (Symmetrical T & π circuit), relationship of Neper & Decibel-Design formulae & numerical.

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

Unit No.	Unit	Teaching Hours / Semester	Marks
1	Basic Terminology	9	9
2	DC Network Theorems	19	27
3	AC Circuits	12	15
4	Networks	12	12
5	Filters and Attenuators	12	12

5. SUGGESTED LIST OF EXPERIMENTS

Sr. No.	LIST OF EXPERIMENTS
1	Verification of Ohms law and its application to series parallel circuits
2	Verification of KVL and KCL
3	Verification of superposition theorem
4	Verification of Thevenins theorem
5	Verification of maximum power transfer theorem
6	Study of RLC series resonance circuits
7	RC Integrator and RC Differentiator
8	Study of filter networks (T and π)

6. SUGGESTED LEARNING RESOURCES

Sr.No.	Author	Title	Publication and Year
1	Schaum series	Electronic Circuits	Latest
2	B.L. Thereja	Basic electrical engineering Vol.1	Latest
3	Royal Signals	Handbook of lines communication	Latest
4	Sudhakar Shyam Mohan	Circuits and networks	Latest

(MX404) PROGRAMMING OF 8051 MICROCONTROLLER IN C

1. RATIONALE:

Microcontrollers are usually programmed using the assembly language. It is usually a very time consuming task to develop large projects using the assembly language. Program debugging and testing are also considerably more complex, requiring more time.

The C programming language, which is a general purpose high level language, offers efficient and compact code and provides elements of structured programming. This will enable the students to develop projects and debug programs considerably faster.

2. TEACHING AND EXAMINATION SCHEME:

Course Code & Course Title	Periods/ Week (In Hours)			Total Credit	Examination Scheme				Total Marks
	L	T	P		TH	TM	TW	PR/OR	
MX 404 Programming of 8051 Microcontroller in C	2	-	3	5	--	--	50	50	100

Minimum passing % : Duration of Theory Paper:

Legends:

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

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

3. DETAILED COURSE CONTENTS

Unit 1	OVERVIEW OF EMBEDDED SYSTEMS	2 hours
Block diagram of a computer, Comparison between a microcontroller and a general purpose microprocessor system, Examples of embedded systems, characteristics of an embedded system, embedded system architecture, typical processors used in embedded systems.		
Unit 2	8051 ARCHITECTURE	2hours
8051 Block diagram, CPU Registers-Registers A, B, Program Status Word, Stack pointer, Data Pointer, Program Counter. Memory Organisation - Program Memory, Internal Data memory, Register Banks, Bit Addressable RAM, General Purpose RAM, SFR Registers. 8051 Pin Diagram and Pin description. Comparison of the 8051 family members.		

Unit 3 hours	8051 C FUNDAMENTALS	6
<p>Structure of a C program for a microcontroller. Header files, The pre-processor, Macros, Include, 8051 C Data types, Constants, Operators-arithmetic, relational, logical , assignment, increment and decrement operators, bitwise operators, arithmetic expressions , precedence of arithmetic operators. Decision making and branching- simple if statement, if...else statement, nested if...else statement, switch statement , goto statement , Decision making and looping - while statement, do..while statement , for statement, continue, break. Pointers and arrays. User defined functions.</p>		
Unit 4 2hours	8051 I/O PORT PROGRAMMING IN C	
<p>Byte size I/O, Bit-addressable I/O, logic operations, Bit-wise operators, Bit-wise shift operations.</p>		
Unit 5 hours	8051 TIMER & COUNTER PROGRAMMING IN C	4
<p>8051 Timers, Timer 0 and Timer1 registers, TMOD Register, TCON Register, Timer Modes of operation. C programming to generating time delays and square waves using Timers. C programming of Timers 0 and 1 as counters.</p>		
Unit 6 hours	8051 INTERRUPTS PROGRAMMING IN C	8
<p>Interrupts versus polling, Interrupt service routine, Steps in executing an interrupt, Interrupts in the 8051, 8051 C interrupt numbers, Interrupt Vector Table for the 8051, Interrupt Enable register, Programming Timer Interrupts, External hardware Interrupts-INT0 and INT1, Level- triggered Interrupt and Edge-triggered Interrupts, Interrupt Priority, Interrupt Priority Register, Setting interrupt priority with the IP register. C programming of interrupts.</p>		
Unit 7 hours	8051 SERIAL PORT PROGRAMMING	4
<p>Basics of serial communication, half and full duplex transmission, asynchronous serial communication and data framing, data transfer rate, RS232 standards, 8051 connection to RS232, SBUF register, SCON register, Programming the 8051 in C to transfer and receive data serially.</p>		
Unit 8 hours	LCD AND KEYBOARD INTERFACING	4
<p>Pin description of LCD, LCD command codes, LCD Addressing, C programming to display data on an LCD. Interfacing a matrix keyboard to the 8051, study of a C program to read a matrix keyboard.</p>		

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

Unit No.	Unit	Teaching Hours / Semester	Marks
1	Overview of embedded systems	2	---
2	8051 Architecture	2	---
3	8051 C Fundamentals	6	---
4	8051 I/O Port Programming in C	2	---
5	8051 Timer & Counter Programming in C	4	---
6	8051 Interrupts Programming in C	8	---
7	8051 Serial Port programming	4	---
8	LCD and Keyboard Interfacing	4	---

5. SUGGESTED LIST OF EXPERIMENTS

Students are required to develop their 'C' code using Keil IDE (Integrated development environment) Evaluation Version. The laboratory exercises should cover I/O Port programming, Timer & Counter Programming, Interrupts Programming , interfacing of LEDs, switches, LCD and matrix keyboards. The programs are to be tested on hardware assembled on bread board or on a microcontroller development board.

Mini Project

As part of the term work, each student will be required to complete a mini project using a microcontroller either on a bread board or on microcontroller development board.

6. SUGGESTED LEARNING RESOURCES

Sr.No.	Author	Title	Publication and Year
1.	Mazidi	The 8051 Microcontroller and Embedded Systems	Latest
2.	E. Balaguruswamy	Programming in ANSI C	Latest
3.	Dogan Ibrahim	Microcontroller projects in C for the 8051	Latest

Semester – V

Course code	Name of Course	Teaching Scheme				Examination Scheme				Total Marks
		L	T	P	C	Theory		Practical		
						TH	TM	PR/OR	TW	
MX501	Medical Instruments-III	3*	-	2*	5	75	25	-	25	125
MX502	Medical Imaging	3*	-	2*	5	75	25	-	25	125
E1	Elective-I	3*	-	2*	5	75	25	25	25	150
MX503	Embedded lab.	-	-	2*	2	-	-		50	50
IT501	Industrial training	-	-	16	16	GRADE				
Total		9		24	33	225	75	25	125	450

***Workload shall be doubled**

ELECTIVES

MX511 Medical Equipment Maintenance

MX512 Biotelemetry

MX513 Biostatistics

Semester – VI

Course code	Name of Course	Teaching Scheme				Examination Scheme				Total Marks
		L	T	P	C	Theory		Practical		
						TH	TM	PR/OR	TW	
MX601	Hospital Management	3	-	2	5	75	25	25	25	150
MX602	Medical Instruments-IV	3	-	2	5	75	25	25	25	150
E2	ELECTIVE-II	3	-	2	5	75	25	25	25	150
E2	Institutional Elective/Elective-II	3	-	2	5	75	25	25	25	150
CS602	Business Comm.	-	-	2	2	-	-	50	50	100
MX603	Medical Electronics Project	-	-	6	6	-	-	50	50	100
Total		12	-	16	28	300	100	200	200	800

ELECTIVES II

MX611 Nuclear Medicine

MX612 Ventilator Management

MX613 Telemedicine

MX614 Principles and Practices of Laboratory Medicine

EN611 Programmable Logic Controller

EN612 Internet technology & Web Design

EN613 Advanced Microcontrollers

EN614 E-Commerce

EN615 Consumer Electronics

ME617 Modern Marketing Management

IE6**-Institutional Elective

SEMESTER V

(MX501) MEDICAL INSTRUMENTS-III

1. RATIONALE:

The students have been exposed to the basics of Medical Instruments like Transducers, Recorders etc. in the lower version of Medical Instruments. Now this course explores the advance technology used in the medical field along with the safety aspects. Students undergoing this course will learn about the basic concept of higher end instruments used in the medical field.

2. TEACHING & EXAMINATION SCHEME

Course Code & Course Title	Periods/Week (In Hours)			Total Credits	Examination Scheme				Total Marks
	L	T	P		Theory Marks		Practical Marks		
					TH	TEST	PR/OR	TW	
MX501 Medical Instruments-III	3	-	2	5	75	25	-	25	125

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

Legends:

L-lecture, T-Tutorial, P-Practical, C-Credit, TH-End Semester Theory, TM-Test Marks

PR/OR-End Semester Practical/Oral Examination, TW-Term Work.

3. DETAILED COURSE CONTENTS

UNIT 1: PATIENT SAFETY. 12HRS (20MKS) Introduction, electric shock hazards, gross and micro current shock. Leakage current & its type, precautions to minimize electric shock hazards, safety codes for electro medical equipment, testing of Biomedical equipment- chassis leakage current measurement, leakage current in patient leads, ground continuity test.
UNIT 2: INSTRUMENTS FOR SURGERY 10HRS (15MKS) Principle of surgical diathermy, safety aspects of active and return electrode, surgical diathermy machine, electro surgery techniques, safety aspects in electro surgical units, laser application in Biomedical field, laser safety.
UNIT 3. PATIENT MONITORING SYSTEM 10HRS (15MKS) System concepts, cardiac monitor, bedside patient monitoring systems, central monitors, blood pressure measurement, automatic blood pressure measuring apparatus using korotkoff's method (sphygmomanometer)
UNIT 4. CARDIAC PACE MAKERS & DEFIBRILLATOR 16HRS (25MKS) Need for cardiac pacemaker, types of pacemaker-external pacemaker, implantable pacemakers, and power sources for implantable pacemakers. Defibrillators- Need for a defibrillator, DC defibrillator, defibrillator electrodes, automatic or advisory external defibrillators.

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

Unit No	Name of the Unit	Teaching Hours/ Semester	Marks
1	Patient Safety	12	20
2	Instruments for surgery	10	15
3	Patient Monitoring System	10	15
4	Cardiac Pacemakers and Defibrillators	16	25

5. SUGGESTED LIST OF EXPERIMENTS

Sr. No	LIST OF EXPERIMENTS
1	Study of surgical diathermy machines.
2	Study of defibrillators.
3	Study of pacemaker.
4	Study of patient monitoring system.
5	Study of nebulizer.
6	Study of LASER based surgical equipments.

6. SUGGESTED LEARNING RESOURCES

Sr.No	Author	Title	Publication and Year
1	R.S Khandpur	Handbook of medical instruments	Latest
2	Leslie Cromwell	Biomedical Instrumentation and Measurements	Latest
3	John Webster	Medical Instrumentation	Latest

(MX502) MEDICAL IMAGING

1. RATIONALE:

Medical Imaging refers to a number of techniques that can be used as non-invasive methods of looking inside the human body. It can be used to assist diagnosis or treatment of various medical conditions. By studying this course students will be able to learn about different imaging techniques which will enable them to work as x-ray technician, MRI technician etc.

2. TEACHING & EXAMINATION SCHEME

Course Code & Course Title	Periods/Week (In Hours)			Total Credits	Examination Scheme				Total Marks
					Theory Marks		Practical Marks		
	L	T	P	C	TH	TEST	PR/OR	TW	
MX502 Medical Imaging	3	-	2	5	75	25	-	25	125

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

Legends:

L-lecture, T-Tutorial, P-Practical, C-Credit, TH-End Semester Theory, TM-Test Marks

PR/OR-End Semester Practical/Oral Examination, TW-Term Work.

3. DETAILED COURSE CONTENTS

UNIT 1: X-ray machines & Digital Radiography.	16HRS (25MKS)
Basis of Diagnostic Radiology, Nature and properties of x-rays, production of x-rays, stationary anode tube, Rotating Anode tube, x-ray machine, collimators & grids, x-ray films, fluorescent screens, x-ray Image intensifier, Dental x-ray machine, catheterization laboratory instrumentation.	
UNIT 2: X-RAY COMPUTED TOMOGRAPHY.	12HRS (20MKS)
Basic principle of computed tomography, system components of CT-All Generations in scanning system, Gantry Geometry, Patient Dose in CT scanners	
UNIT 3. MAGNETIC RESONANCE IMAGING (MRI) & THERMAL IMAGING SYSTEM	10HRS (15MKS)
Principles of MRI systems, Basic NMR components, Biological effects of NMR imaging, advantages of NMR imaging system, Medical thermography, Infrared detectors, Thermographic equipment.	
UNIT 4. ULTRASONIC IMAGING SYSTEM	10HRS (15MKS)
Diagnostic ultrasound, properties of ultrasound, Basic modes of transmission, ultrasonic imaging, different display modes in ultrasonic imaging, medical ultrasound, Echocardiography, Real time ultrasonic imaging systems & its requirements.	

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

Unit No	Name of the Unit	Teaching Hours/ Semester	Marks
1	X-ray machines & Digital radiography	16	25
2	X-ray computed tomography	12	20
3	Magnetic resonance imaging and thermal imaging	10	15
4	Ultrasonic imaging system	10	15

5. SUGGESTED LIST OF EXPERIMENTS

Sr. No	LIST OF EXPERIMENTS
1	Study of x-ray machine.
2	Study of image intensifier.
3	Study of CT-scanner.
4	Study of MRI scanner.
5	Study of sonography machine.
6	Study of medical thermography.

6. SUGGESTED LEARNING RESOURCES

Sr.No	Author	Title	Publication and Year
1	R.S Khandpur	Handbook of medical instruments	Latest
2	Leslie Cromwell	Biomedical Instrumentation and Measurements	Latest
3	John Webster	Medical Instrumentation	Latest

(MX503) EMBEDDED LAB

1. RATIONALE:

The past few decades have witnessed evolution of microcontrollers. They have revitalized a number of products or equipment in almost all fields including telecommunications, medical, industrial, and consumer electronics.

This course will impart the necessary software and hardware testing skills to the students who are already introduced to the use of 8051 microcontrollers thus enabling them to develop successful projects.

2. TEACHING AND EXAMINATION SCHEME:

Course Code & Course Title	Periods/ Week (In Hours)			Total Credit	Examination Scheme				Total Marks
					Theory Marks		Practical Marks		
	L	T	P	C	TH	TM	TW	PR/OR	
MX503 EMBEDDED LAB	-	-	2	2	-	-	50	-	50

Minimum passing % :Theory 40%

Duration of Theory Paper: 3 Hrs.

Legends:

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

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

Legends: R = Remembrance; U= Understanding; A= Application and above levels

3. SUGGESTED LIST OF EXPERIMENTS:

(Minimum 6)

Sr. No.	LIST OF EXERCISES
1	Study of Keil IDE software to program 8051 series microcontrollers in Assembly and C
2	LED interfacing.
3	Keyboard interfacing

4	Stepper motor interfacing
5	Interfacing of temperature sensors
6	DC motor interfacing
7	LCD interfacing
8	Introduction to PIC microcontrollers
9	Introduction to MPLAB
10	Introduction to PICBASIC
11	Introduction to Arduino development board

4. SUGGESTED LEARNING RESOURCES

Sr.No.	Author	Title	Publication and Year
1.	Muhammad Ali Mazidi	The 8051 Microcontroller and Embedded Systems Using Assembly and C	latest
2.	Simon Monk	30 arduino projects for the evil genius	latest
3	MykePredko	123 PIC Microcontroller Experiments for the Evil Genius	latest

(IT501) INDUSTRIAL TRAINING

1. RATIONALE:

Industrial Training is a newly introduced component, in the curriculum under Revised Semester Pattern system for all 03 year Diploma Programmes. It is a Training programme designed to expose & prepare the students for the Industrial work situation. This exposure and hands on experience, will further enhance the prospects of student fraternity to be better placed on completion of their course.

2. TEACHING AND EXAMINATION SCHEME

Course code & course title	Periods/Week (in hours)			Total Credits	Examination Scheme				Total Marks
					Theory		Practical		
	L	T	P	C	TH	TM	PR/OR	TW	
IT501 INDUSTRIAL TRAINING	-	-	16	16	-	-	30	70	Grade

Minimum passing %: 40%

Legends:

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

3. DETAILED COURSE CONTENTS

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. Safety Practices / Safety Equipments
14. Utilities
15. Logistics
16. Sales and Marketing
17. Ethics, Statutory Rules and Regulations followed
18. Product Design and Development
19. Any other area specific to the Industry providing Training

4. TERM WORK & PRACTICALS

Evaluation Scheme					
TW				PR/OR	TOTAL Marks
Attendance Marks*	Industrial Mentor's assessment Marks	Institute Mentor's assessment Marks	Training Report	Report Assessment & Seminar/Viva	
10	20	20	20	30	100

* 01 mark shall be deducted for every Absence (with or without permission).

Daily Dairy

The daily dairy should-be maintained in a book. It should reflect the day to day activities performed by the student (including task, men and materials involved). It should be counter signed by the Industry Mentor. It will become the basis for writing reports on the complete training.

Training Report

The training report should be submitted by the training students should include the following salient points- Certificate from institute, Certificate of training from company, detailed write up as per daily dairy, detailed drawings, working drawings, photographs, safety precautions, techniques for work minimization on site, organizational chart, Importance of project to the society, special methods/techniques/equipment should be separately high lightened, including environmental aspects. The report should be informative and technical, typed with double spacing on good quality bond paper and bound.

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

Note :

- a. Student/s undergoing Industrial Training shall follow Rules and Regulations of the Industry.
- b. Industrial Training will generally be organised and conducted in accordance with Industrial Training Manual duly prescribed by the Board.

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

Unit No	Name of the Unit	Teaching Hours	Marks
1	PR/OR	} 08 Weeks	30
2	TW		70
	Total	08 Weeks	100

Note:

1. For Industrial training Grades will be awarded based on marks scored as follows:

80% and above Marks – Grade ‘A’

60% to 79% Marks – Grade ‘B’

40% to 59% Marks – Grade ‘C’

Marks below 40% - Grade ‘D’

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

(MX511) MEDICAL EQUIPMENT MAINTENANCE

1. RATIONALE:

It is well established that a comprehensive maintenance programme can prevent equipment failure which impacts productivity, worker morale and financial returns. The goal of maintenance engineering should be to ensure top quality performance from each piece of hardware which can be achieved by establishing and practicing a good maintenance management system.

2. TEACHING AND EXAMINATION SCHEME:

Course Code & Course Title	Periods/ Week (In Hours)			Total Credit	Examination Scheme				Total Marks
					Theory Marks		Practical Marks		
	L	T	P	C	TH	TM	TW	PR/OR	
MX511 MEDICAL EQUIPMENT MAINTENANCE	3	-	2	5	75	25	25	25	150

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

Legends:

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

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

3. DETAILED COURSE CONTENTS

Unit-I Troubleshooting Procedures (12 hrs) (15 marks)

Reliability curve, failure rate, accelerated assessment of reliability, thermal acceleration, electrical acceleration, damp heat acceleration.

Maintenance terminology- troubleshooting, breakdown maintenance, preventive maintenance, inspection, acceptance test, calibration, overhaul.

Causes of equipment failures, nature of faults.

Troubleshooting process- fault establishment, fault location procedure. Troubleshooting methods- functional area approach, split half method ,troubleshooting circuits with -divergent paths, convergent paths, feedback paths, switching paths.

Unit-II Maintenance management (08 hrs) (15marks)

Objectives of maintenance management, essentials of a good equipment management programme, maintenance policy, equipment service options, types of maintenance service contracts, general contract provisions, maintenance organization, planning of spare parts inventory, prioritization procedure for purchase of spare parts requirement

Unit-IV Electrical Earthing and safety devices (08hrs) (15marks)

Definition of electrical earthing, need for earthing, types of earthing-system

earthing, equipment earthing, types of earthing electrodes.

Earth leakage circuit breaker- construction, principle of operation and applications.

Miniature circuit breaker- construction, principle of operation and applications.

Unit-V Motors and Transformers(08hrs) (15marks)

DC motor-principle of operation, DC shunt motor-construction and reversal of rotation, permanent magnet Dc motor, universal motor-construction and principle operation.

Transformer- principle of operation, construction of single phase transformers(core type and shell type) used in electronic equipment. VA rating of transformers.

Variac- principle of operation.

Unit-VI Medical Equipment Maintenance (12 hrs) (15marks)

Operation and function of the following medical equipment (along with troubleshooting chart and user maintenance check list)-Anaesthetic Machines, Autoclaves and Sterilizers, ECG (Electrocardiograph) Machines, Electrosurgical Units (ESU) and Cautery Machines, Incubators, Nebulizers, Oxygen Cylinders and Flowmeters, Suction Machines (Aspirators), Tables (Operating Theatre and Delivery), Ultrasound Machines, X-Ray Machines.

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

Unit No.	Unit	Teaching Hours / Semester	Marks
1	Troubleshooting Procedures	12	15
2	Maintenance management	08	15
3	Electrical Earthing and safety devices	08	15
4	Motors and Transformers	08	15
5	Medical Equipment Maintenance	12	15

Legends: R = Remembrance; U= Understanding; A= Application and above levels

5. SUGGESTED LIST OF EXPERIMENTS

Sr. No.	LIST OF EXPERIMENTS
1	Study of hand tools and chemicals for servicing and maintenance
2	Study of electronic test equipment-multimeters
3	Study of electronic test equipment-analog and digital storage oscilloscopes
4	Study of electronic test equipment-logic analyser and signal generators
5	Study of soldering tools and soldering and desoldering techniques
6	Testing of transformers, relays and inductors
7	Testing of resistors and capacitors
8	Testing of diodes, BJTs , FETs and thyristors
9	Handling of digital ICs and troubleshooting techniques of digital circuits
10	Study of repairs and maintenance of an ECG machine
11	Study of repairs and maintenance of an X-ray machine

6. SUGGESTED LEARNING RESOURCES

Sr.No.	Author	Title	Publication and Year
1.	R.S. Khandpur	Troubleshooting electronic equipment	latest
2.	Ministry of Health and Family Welfare, New Delhi	Medical Equipment Maintenance Manual	2010

(MX512) BIO-TELEMETRY

1. RATIONALE:

Telemetric transmission of functional and physiological information offers many advantages in medical diagnostics and patient surveillance. The telemetric data link avoids direct connections to the recording equipment, which are sometimes embarrassing and restraining, thus leaving the patient freely movable. The course helps to understand this new and emerging field.

2. TEACHING & EXAMINATION SCHEME

Course Code & Course Title	Periods/Week (In Hours)			Total Credits	Examination Scheme				Total Marks
					Theory Marks		Practical Marks		
	L	T	P		C	TH	TEST	PR/OR	
MX512 Bio-Telemetry	3	-	2	5	75	25	25	25	150

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

Legends:

L-lecture, T-Tutorial, P-Practical, C-Credit, TH-End Semester Theory, TM-Test Marks

PR/OR-End Semester Practical/Oral Examination, TW-Term Work.

3. DETAILED COURSE CONTENTS

UNIT 1: Introduction of Communication Systems. 09HRS (15MKS)

Classification of communication networks. The variety and description of Telecommunication traffic. The conversion of analog and digital signals. The transmission of information. The relationship between information, bandwidth and noise. Noise in communication systems:-probability and random signals. Errors in digital communication. Cathode ray tube. Block diagram of communication system.

UNIT 2: Modulation systems.09HRS (15MKS)

Time, frequency and bandwidth, analog modulation and demodulation. AM, FM, PM. Digital modulation. P.W.D-Pulse Width Modulation. Digital Demodulation. Transmitter and Receiver. (Antenna etc)
F.D.M-Frequency Division Multiplexing, T.D.M-Time Division Multiplexing, Sub-carrier Modulator/Demodulator, RF amplifier/RF receiver, IF amplifier, Notch Fitter, Charge coupled Device (C.C.D), Digital communication.

UNIT 3: Bio-Telemetry Systems.15HRS (25MKS)

- 1) Single channel Telemetry system.
- 2) E.C.R Telemetry system.
- 3) Temperature Telemetry system.
- 4) Multi-channel wireless Telemetry systems.
- 5) Telemetry of ECG and respiration.
- 6) Implantable Telemetry System for Blood Pressure and Blood flow.

UNIT 4. Transmission of Bio-medical signals.15HRS (20MKS)

Transmission lines, optic fibre cables. Satellite communication. Mobile communication. Introduction to Telemedicine, Applications of Telemedicine. Essential Parameter for Telemedicine. Telemedicine Technology, (Transmission of Medical images, video images, digital audio) Use of Internet resource of Telemedicine.

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

Unit No	Name of the Unit	Teaching Hours/ Semester	Marks
1	Introduction of Communication Systems.	09	15
2	Modulation systems.	09	15
3	Bio-Telemetry Systems.	15	25
4	Transmission of Bio-medical signals.	15	20

5. SUGGESTED LIST OF EXPERIMENTS

Sr. No	LIST OF EXPERIMENTS
1	Study of AM/FM modulator, demodulator, and detector.
2	Study of LAN Systems.
3	Study of Modems.
4	Ambulance Telemetry Systems (108)
5	Study application of telemedicine.

6. SUGGESTED LEARNING RESOURCES

Sr.No	Author	Title	Publication and Year
1	George Kennedy	Electronic Communication Systems	Latest
2	Young	Electronic Communication Technique	Latest

(MX513) BIOSTATISTICS

1. RATIONALE:

The science of statistics has a definite place in the skill sets of Medical Electronics Technician. Knowledge of statistical methods opens up new paths of experimental procedures and helps the students to understand and interpret the facts and findings of medical research.

2. TEACHING AND EXAMINATION SCHEME:

Course Code & Course Title	Periods/ Week (In Hours)			Total Credit	Examination Scheme				Total Marks
					Theory Marks		Practical Marks		
MX513 BIOSTATISTICS	L	T	P	C	TH	TM	TW	PR/OR	150
		3	-	2	5	75	25	25	

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

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

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

3. DETAILED COURSE CONTENTS

<p>Unit-I-INTRODUCTION(03hrs) (06marks)</p> <p>Meaning of statistics; limitations in statistics; medical statistics: application & uses of Bio statistics as a science. Common statistical terms: variable, constant, observation, observatorial unit, Data, population, sampling unit, sample parameter, and statistic. Notation for population & sample value.</p>
<p>Unit-II SOURCES & PRESENTATION OF DATA(04hrs) (08marks)</p> <p>Sources for collection of medical statistics namely, experiments, surveys, records methods of presentation: Tabulation; frequency distribution drawings for quantitative and qualitative data.(problems)</p>
<p>Unit-III MEASURES OF LOCATION –AVERAGES AND PERCENTILES (06hrs) (09 marks)</p> <p>Measures of central tendency-Averages, mean, median, mode (simple numerics) Measures of location- Percentiles, graphic method and Arithmetic method (problems also). Application & uses of percentile.</p>
<p>Unit-IV VARIABILITY & IT'S MEASURES(10hrs) (12marks)</p> <p>Types of variability Biological real and experimental. Measures of variability of individual observation; range interquartile range, mean deviation, standard deviation (problems also).Coefficient of variation (problems also).</p>
<p>Unit-V NORMAL DISTRIBUTION AND NORMAL CURVE (02hrs) (04marks)</p> <p>Demonstration of normal distribution .Normal curve.Asymmetric distribution.</p>
<p>Unit-VI SAMPLING(08hrs) (12 marks)</p> <p>Sample characteristics-Precision and unbiased character (simple problems based on formulae) Sampling techniques- Simple random sampling, systematic sampling, stratified sampling, multistage sampling, cluster sampling, multiphase sampling.</p>

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<p>UNIT-VII SIGNIFICANCE OF DIFFERENCE IN MEANS(04hrs) (06 marks) Significance of difference between means of small samples by student's t-test—unpaired t-test, paired t-test. Simple numericals.</p>
<p>UNIT-VIII CORELATION AND REGRESSION (04hrs) (04marks) Measures of relationship between continuous variables; types of co-relation Regression- meaning and its relation with 'co-relation'</p>
<p>UNIT-IX DESIGNING AND METHODOLOGY OF AN EXPERIMENT OR A STUDY:(03hrs) (06marks) Steps in methodology and designing.Presentation briefs.</p>
<p>UNIT-X DEMOGRAPHY AND VITAL STATISTICS (04hrs) (06marks) Demography- Meaning and types; vital statistics- definition; sources for collection of demographic data- Population census, records of health departments, records of health institutions, reports of special surveys.</p>

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

Unit No.	Unit	Teaching Hours / Semester	Marks
1	Introduction	3	06
2	Sources & presentation of data	4	08
3	Measures of location – averages and percentiles	6	09
4	Variability & it's measures	10	12
5	Normal distribution and normal curve	02	04
6	Sampling	08	12
7	Significance of difference in means	04	06
8	Co-relation and regression	04	06
9	Designing and methodology of an experiment	03	06
10	Demography and vital statistics	04	06

Legends: R = Remembrance; U= Understanding; A= Application and above levels

5. SUGGESTED LIST OF EXPERIMENTS

Sr. No.	LIST OF EXPERIMENTS
1	Presentation of qualitative data from experiments conducted in medical lab through histogram and frequency polygon.
2	Plot bar graphs from experiments conducted in medical electronics lab.(simple, multiple, proportional)
3	Plot pie charts from experiments related to medical electronics
4	Find mean , median, mode from experiments
5	Plot cumulative frequency graph and find percentiles, deciles , quantiles
6	To find standard deviation
7	Unpaired students t-test
8	Paired students t-test
9	Mini project involving collection of data from experiments/survey/records and present it involving 'steps in methodology and designing'.

6. SUGGESTED LEARNING RESOURCES

Sr.No.	Author	Title	Publication and Year
1.	Dr. B. K. Mahajan	Methods in Biostatistics	Latest
2.			Latest
3.			

SEMESTER VI

(MX601) HOSPITAL MANAGEMENT

1. RATIONALE:

Health care is the world's largest industry. Hospitals today have to meet the needs of patients and the total focus has shifted to 'patient services' instead of only medical and surgical therapies. Health management or hospital management is the field relating to leadership, management, and administration of public health systems, health care systems, hospitals, and hospital networks

2. TEACHING & EXAMINATION SCHEME

Course Code & Course Title	Periods/Week (In Hours)			Total Credits	Examination Scheme				Total Marks
					Theory Marks		Practical Marks		
	L	T	P		C	TH	TEST	PR/OR	
MX601 Hospital Management	3	-	2	5	75	25	25	25	150

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

Legends:

L-lecture, T-Tutorial, P-Practical, C-Credit, TH-End Semester Theory, TM-Test Marks

PR/OR-End Semester Practical/Oral Examination, TW-Term Work.

3. DETAILED COURSE CONTENTS

<p>UNIT 1:HEALTH CARE IN INDIA 4hrs(05mks) Hospitals & Administrators</p>
<p>UNIT 2:PLANNING A MODERN HOSPITAL :12hrs (20mks) Introduction, Location, Market survey, Financial Planning, Sources of Funds, Important considerations while planning aHospital, Basic minimum requirements for aSmall hospital: Facilities, BedDistribution, space and physical requirements, Siteplanning, constructional requirements, outpatient department, in-patient nursing units.</p>
<p>UNIT 3:FINANCIAL MANAGEMENT FOR HOSPITALS 10hrs(15mks) Introduction, Investment Activities, Project report, Financial Activities: Stagesof Project, Financial Planning, sources of Finance, Operation Activities: Methodsto improve the profits of hospitals. Measurement of the efficiency of Hospitals.</p>

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<p>UNIT 4:HUMAN RESOURCE MANAGEMENT IN HOSPITALS 10hrs(15mks) Introduction, objectives of HRM System in Hospitals, Procurement of HumanResources, Human Resource planning in Hospitals: Manpower estimation, Recruitment, Selection, Induction, Placement. Development of Human Resources: Training, Performance Appraisal, career development. Human Resource Information system (HRIS)</p>
<p>UNIT 5:MEDICAL RECORDS 6hrs(10mks) Purpose, uses, value, organizing the Medical Records Dept., Development and Content of the Hospital Medical Record, Required characteristics of entries in Medical Records, Legal aspects of Medical Records, Computerization of Medical Records.</p>
<p>UNIT 6:HOSPITAL WASTE MANAGEMENT 6hrs (10mks) Waste Groups, waste management, waste collection, waste disposal waste treatment, waste minimization options.</p>

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

Unit No	Name of the Unit	Teaching Hours/ Semester	Marks
1	Health care in India	04	05
2	Planning a modern hospital	12	20
3	Financial management for hospitals	10	15
4	Human resource management in hospitals	10	15
5	Medical records	06	10
6	Hospital waste management	06	10

5. SUGGESTED LIST OF EXPERIMENTS

Sr. No	LIST OF EXPERIMENTS
1	Study of space and physical requirements while planning a hospital.
2	Study of maintaining medical records.
3	Study of preparing computerized formats for medical records
4	Study of various selective controls used in hospital material management.
5	Study of categories of biomedical waste ,containers,colour codes.
6	Study of hospital waste management
7	Study of hospitals stores organization and pharmacy
8	Onfield visit to a Hospital

6. SUGGESTED LEARNING RESOURCES

Sr.No	Author	Title	Publication and Year
1	A.V. Srinivasn	Managing a Modern Hospital -Second Edition.	www.sagepublications.com

(MX602) MEDICAL INSTRUMENTS-IV

1. RATIONALE:

This course describes the higher end Medical Instruments which are mostly used in the hospitals. This course covers the instruments which are used during surgery & for the Diagnosis & therapeutic purposes.

2. TEACHING & EXAMINATION SCHEME

Course Code & Course Title	Periods/Week (In Hours)			Total Credits	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
	L	T	P	C	TH	TEST	PR/OR	TW	
MX602 Medical Instruments-IV	3	-	2	5	75	25	25	25	150

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

Legends:

L-lecture, T-Tutorial, P-Practical, C-Credit, TH-End Semester Theory, TM-Test Marks

PR/OR-End Semester Practical/Oral Examination, TW-Term Work.

3. DETAILED COURSE CONTENTS

UNIT 1: ANESTHESIA MACHINE.14HRS (20MKS)

Need for anesthesia, delivery of anesthesia, anesthesia machine, Gas supply system, vapor delivery, delivery system, Humidification, ventilators, patient circuit, electronics in the anesthetic machine.

UNIT 2: AUTOMATED DRUG DELIVERY SYSTEM12HRS (20MKS)

Infusion pumps, components of drugs infusion systems, delivering the drug, syringe pumps, closed loop control in infusion systems, programmable volumetric infusion pump, programme controlled insulin dosing device .

UNIT 3. HEMODIALYSIS MACHINE & LITHOTRIPTERS 12HRS (20MKS)

Function of the kidneys, artificial kidney, dialyzers & its types, hemodialysis machine. Lithotripters:-Modern Lithotripter systems, Extra Corporeal Shock wave therapy.

UNIT 4. ENDOSCOPY10HRS (15MKS)

Introduction, various types of endoscopes, cystoscopes, fiber optic endoscopes & endoscopes with integral TV cameras, .

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

Unit No	Name of the Unit	Teaching Hours/ Semester	Marks
1	Anesthesia Machine	14	20
2	Automated Drug Delivery System	12	20
3	Hemodialysis Machines & Lithotripters	12	20
4	Endoscopy	10	15

5. SUGGESTED LIST OF EXPERIMENTS

Sr. No	LIST OF EXPERIMENTS
1	Study of Anesthesia Unit
2	Study of Ventilators.
3	Study of Infusion Pump.
4	Study of Dialysis Machine.
5	Study of Lithotripter(ESWL).
6	Study of Endoscopes.

6. SUGGESTED LEARNING RESOURCES

Sr.No	Author	Title	Publication and Year
1	R.S Khandpur	Handbook of medical instruments	Latest
2	Leslie Cromwell	Biomedical Instrumentation and Measurements	Latest
3	John Webster	Medical Instrumentation	Latest

(MX603) MEDICAL ELECTRONICS PROJECT

1. RATIONALE:

This course will provide a platform to the student to apply the concepts learned during previous semesters to the field of medical electronics to design and develop innovative equipments/software, troubleshoot and repair medical electronic equipment, find solutions to industry related problems, etc.

2. TEACHING & EXAMINATION SCHEME

Course Code & Course Title	Periods/Week (In Hours)			Total Credits	Examination Scheme				Total Marks
					Theory Marks		Practical Marks		
	L	T	P	C	TH	TEST	PR/OR	TW	
MX603 MEDICAL ELECTRONICS PROJECT	-	-	6	6	-	-	50	50	100

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

Legends:

L-lecture, T-Tutorial, P-Practical, C-Credit, TH-End Semester Theory, TM-Test Marks

PR/OR-End Semester Practical/Oral Examination, TW-Term Work.

A project may be chosen from any one of the fields given below:

1	Projects related to designing electronic equipment/ instruments
2	Projects related to designing of any health care equipment/gadget
3	Projects related to designing of Android Apps.
4	Projects related to increasing productivity
5	Projects related to quality assurance
6	Projects connected with repair and maintenance of plant and equipment
7	Projects related to design, fabrication, testing and application of electronic circuits and components.
8	Projects related to microprocessor based circuitry/ instruments.
9	Projects related to design, fabrication, testing and troubleshooting of medical electronics equipment
10	Software related projects.
11	Any other related problems of interest to industry

(CS602) BUSINESS COMMUNICATION

1. RATIONAL :

The course on Business Communication will help in development of speaking, listening, writing, and reading skills in students, with special reference to business environment like writing business letters, notes, reports, documents, holding meetings and discussions, working in groups, etc. . Special provision has been made for language workshops where the communication skills of the students can be enhanced.

2. Teaching and Examination Scheme :

Course Code & Course title	Periods per week in hours			Total credits	Examination scheme				
					Theory Marks		Practical Marks		TOTAL Marks
	L	T	P		C	TH	TM	PR/OR	TW
(CS602) Business Communication	-	-	2	2	-	-	50	50	100

3. Competences to be developed through this course :

The course content should be taught and implemented with the aim to develop different type of skills leading to the achievement of the competency “Communicate effectively in given Business situations”.

4. Detailed Course Content :

<p>Unit 1.1: Communication Skills in the work place Communication within the organizational, Types of communication, functions of Internal & external communications Definition, components, importance of effective communication skills, types- verbal-non verbal, methods and hints to improve communication skills, body language, Précis and comprehension</p>
<p>Unit 1.2: Modern Office technology for communications: Using technology and internet to obtain information about suppliers, their credibility, latest specification of items, contacting people, quick feedback, social networking, skype, whatsapp, spell check, dissemination of information, send email to staff, paperless office, etc</p>
<p>Unit 2.1: Seminars Objectives, topic selection, audience, structure, tips for good beginning and end, aids to presentation.</p>
<p>Unit 2.2: Project work: A link between the theory and the practical Tips: Narrow down to the topic, specific not vague, data collection, structure, critical thinking and analysis.</p>

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<p>Unit 3.1 : Report writing: Understanding Objective and Subjective report writing (i)<u>Feasibility report:</u> Definition, types, economic feasibility, technical feasibility, definition. (ii) <u>Trouble Report:</u> Purpose, instances when trouble reports are written, procedure followed in writing trouble report (iii) Formal Reports: Essay, Pamphlet, Booklet or Book report, Parts of a book Report, understanding how to write formal reports</p>
<p>Unit 3.2 : Illustrations in a report: Uses, types, Use of illustrations: Tables, graphs, charts, Venn diagram, organizational charts, flow charts, maps, photographs, drawings and diagrams.</p>
<p>Unit 4.1: Topic -Letter writing: Credit letter, Collection and sales letters</p>
<p>Unit 4.2: Memorandum: Definition, difference from letter, examples of memorandum</p>
<p>Unit 5.1: Meetings: Preparation, Notice for the meetings, Agenda</p>
<p>Unit 5.2.: Note taking during meetings, minutes of meeting</p>
<p>Unit 6.1: Tender: Procedure, Preparation, Types of tenders, Single tender, local tender, e tender, Structure, Tender Notice, Terms and conditions, Payment details, specification, Documents to be submitted, placing orders, Evaluations, drafting advertisements for tenders</p>
<p>Unit 7: Job Interviews: Preparing for a Job Interview, guidelines on facing job interviews, ways of scouting for jobs, Writing Job Application, resume,</p>

Marking scheme :

Term Work	Maximum marks
Overall classroom performance.....	10
Workbook (assignments).....	25

Classroom activity (language workshop).....15

Term End Assessment

Components	Maximum marks
Questions on syllabus.....	20
Activity.....	30

4. Suggested specification table with hours and marks (Practical) :

Unit No	Topic	Teaching hours per semester
1.	Communication Skills in the work place	04
2.	Organizing seminars, project work	04
3.	Report writing	05
4.	Letter Writing	05
5.	Meeting	05
6.	Tenders	04
7.	Job interviews	05
	Total hours	32

5. Suggested learning resources :

1. Business Correspondence and report writing, by R C Sharma & Krishna Mohan, Tata Mcgraw hill, New Delhi 2002,
2. Principles and practices of Business Communication ,Doctor R. Doctor A., Seth Publishers,14th edition,2006
3. The functional aspects of communication skills, P. Prasad, Sharma K. Rajendra, S. K. Kataria and Sons,2006
4. Raul R. Timm, How to make winning presentations, Sneha printers, Mumbai,
5. Stand and Deliver, how to become a masterful communicator and public speaker,
6. Dale Carnegie Training, CPI Cox & Wyman, UK.

(MX611) NUCLEAR MEDICINE

1. RATIONALE:

The Objective of this course is to study the effects of radiation in matter & how isotopes are produced. In this course students will learn different types of radio diagnostic techniques & know techniques used for visualizing different sections of the body. This course covers radiation therapy methodologies & the radiation safety.

2. TEACHING & EXAMINATION SCHEME

Course Code & Course Title	Periods/Week (In Hours)			Total Credits	Examination Scheme				Total Marks
					Theory Marks		Practical Marks		
	L	T	P	C	TH	TEST	PR/OR	TW	
MX611 Nuclear Medicine	3	-	2	5	75	25	25	25	150

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

Legends:

L-lecture, T-Tutorial, P-Practical, C-Credit, TH-End Semester Theory, TM-Test Marks

PR/OR-End Semester Practical/Oral Examination, TW-Term Work.

3. DETAILED COURSE CONTENTS

UNIT 1: BASICS OF NUCLEAR PHYSICS	06HRS (12MKS)
Radio activity, radioactive decay law, units of radioactivity measurement, interaction of radiation with matter.	
UNIT 2: DETECTORS IN NUCLEAR MEDICINE	04HRS (10MKS)
Scintillation detectors and solid state detectors	
UNIT 3. IN VIVO TECHNIQUES	13HRS (17MKS)
General principle, radiopharmaceuticals-selection & localization, uptake monitoring system, rectilinear scanner, Gamma Camera fundamentals.	
UNIT 4. EMISSION TOMOGRAPHY TECHNIQUES	14HRS (20MKS)
Introduction, principles & applications of SPECT, principles & applications of PET, System performance parameters & quality control functions.	
UNIT 5. RADIATION SAFETY	11 HRS(16MKS)
External radiation hazards & prevention, internal radiationexposure, Biological effects of radiation exposure, Disposal of biological waste.	

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

Unit No	Name of the Unit	Teaching Hours/ Semester	Marks
1	BASICS OF NUCLEAR PHYSICS	06	12
2	DETECTORS IN NUCLEAR MEDICINE	04	10
3	IN VIVO TECHNIQUES	13	17
4	EMISSION TOMOGRAPHY TECHNIQUES	14	20
5	RADIATION SAFETY	11	16

5. SUGGESTED LIST OF EXPERIMENTS

Sr. No	LIST OF EXPERIMENTS
1	Study of Gamma Camera
2	Study of Rectilinear Scanner
3	Study of PET
4	Study of SPECT
5	Study of methods of disposal of Different waste.
6	Study of Scintillation detectors.

6. SUGGESTED LEARNING RESOURCES

Sr.No	Author	Title	Publication and Year
1	A.F.G Rocha	Text book of Nuclear Medicine	Latest
2	Bairi, Singh, Rathod, Narurkar	Hand book of Nuclear Medicine Instruments	Latest

(MX612) VENTILATOR MANAGEMENT

1. RATIONALE:

This course attempts to familiarize the students with the concepts that underlie mechanical ventilation and enable them in understanding the principles that govern ventilator management.

2. TEACHING AND EXAMINATION SCHEME:

Course Code & Course Title	Periods/Week (In Hours)			Total Credit	Examination Scheme				Total Marks
	L	T	P		TH	TM	TW	PR/OR	
MX612 VENTILATOR MANAGEMENT	3	-	2	5	75	25	25	25	150

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

Legends:

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

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

3. DETAILED COURSE CONTENTS

<p>Unit-I Basic Concepts in Mechanical Ventilation(18hrs) (24marks) Mechanics of respiration- organs of respiration, process of respiration. Artificial ventilation: -Negative pressure ventilators- -Tank Ventilator (Iron Lung); Positive pressure ventilators. Advantages and disadvantages of negative and positive pressure ventilators. Ventilator terms-- patient circuit, lung compliance, airway resistance, Mean Airway Pressure, Inspiratory Pause Time, Inspiratory Flow, Expiratory Flow, Tidal Volume, Minute Volume, Respiration Rate, Inspiratory Expiratory Phase Time Ratio (I:E Ratio) , Oxygen Percentage(FiO₂), Peak Airway Pressure, Spontaneous Ventilation, Mandatory Minutes Volume Ventilation(MMV), Controlled Mandatory Ventilation, Positive End Expiratory Pressure(PEEP), Continuous Positive Airway Pressure(CPAP). Assist/ Control Ventilation. Elements of a mechanical ventilator--control system, internal pneumatic circuit--single and double internal pneumatic circuit ventilator, external pneumatic circuit,power transmission and conversion system ,Compressors (Blowers), Volume-displacement devices(bellows, pistons), Flow-Control Valves, Basic Elements of a Patient Circuit. Block diagram level working of a microprocessor controlled ventilator. Classification of Ventilators</p>
<p>Unit-II Modes of Ventilation(08 hrs) (15marks) Basic model of ventilation in the lung during inspiration, Equation of Motion, factors controlled and measured during inspiration, four phases of a breath , phase variables – Trigger variable, Limit variable, cycle variable, The Baseline Variable. Types of Breaths-Mandatory breaths, Spontaneous breaths, Assisted Breaths. Modes of Ventilation- Continuous Mandatory Ventilation(CMV) , Intermittent mandatory ventilation (IMV), Synchronized Intermittent Mandatory Ventilation, Continuous spontaneous ventilation (CSV), Spontaneous Breathing, Continuous Positive Airway Pressure (CPAP) , Pressure-support ventilation (PSV).</p>

Unit-IV Ventilator Settings(08hrs) (15marks)

Setting of :Tidal Volume (Volume-Targeted Ventilation , Pressure-Targeted Ventilation), Flow Rate, Respiratory Rate, Ratio of Inspiration to Expiration (I:E Ratio), Flow Profile, Trigger Sensitivity, PEEP.

Optimizing Ventilator Settings for Better Oxygenation.

Unit-V Ventilator Alarms (08hrs) (15marks)

Low Expired Minute Volume Alarm
 High Expired Minute Volume Alarm
 Upper Airway Pressure Limit Alarm
 Low Airway Pressure Limit Alarm
 Oxygen Concentration Alarms
 Low Oxygen Concentration (FIO₂) Alarm
 Upper Oxygen Concentration(FIO₂) Alarm
 Power Failure
 Apnea Alarm

Unit-VI Neonatal and Pediatric Mechanical Ventilation (06hrs) (06marks)

Recognizing the need for mechanicalventilatory support in neonates, Clinical Indications for Respiratory Failure, Determining effective Oxygenation andVentilation , goals of newborn and pediatricventilatorysupport , Nasal Continuous Positive Airway Pressurein Neonates

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

Unit No.	Unit	Teaching Hours / Semester	Marks
1	Basic Concepts in Mechanical Ventilation	18	24
2	Modes of Ventilation	08	15
3	Ventilator Settings	08	15
4	Ventilator Alarms	08	15
5	Neonatal and Pediatric Mechanical Ventilation	06	06

Legends: R = Remembrance; U= Understanding; A= Application and above levels

5. SUGGESTED LIST OF EXPERIMENTS

Sr. No.	LIST OF EXPERIMENTS
1	Study of various ventilator service manuals
2	Study of ventilator waveforms
3	Study of complications in ventilator supported patients.
4	Study of Weaning Parameters for discontinuation of mechanical ventilation
5	Case studies
6	Field visit to hospitals

6. SUGGESTED LEARNING RESOURCES

Sr.No.	Author	Title	Publication and Year
1.	J.M. Cairo	Pilbeam's mechanical ventilation: physiological and clinical applications	Latest
2.	Ashfaq Hasan	Understanding Mechanical Ventilation-A Practical Handbook	Latest

(MX613) TELEMEDICINE

1. RATIONALE:

Telemedicine is the broad description of providing medical and healthcare services by means of telecommunications. Information Technology (IT), has enabled a wide range of applications to be supported. To address the growing trend of telemedicine throughout the world, this course discusses different technologies and applications surrounding telemedicine.

2. TEACHING & EXAMINATION SCHEME

Course Code & Course Title	Periods/Week (In Hours)			Total Credits	Examination Scheme				Total Marks
	L	T	P		Theory Marks		Practical Marks		
				C	TH	TEST	PR/OR	TW	
MX613 Telemedicine	3	-	2	5	75	25	25	25	150

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

Legends:

L-lecture, T-Tutorial, P-Practical, C-Credit, TH-End Semester Theory, TM-Test Marks

PR/OR-End Semester Practical/Oral Examination, TW-Term Work.

3. DETAILED COURSE CONTENTS

<p>UNIT 1: Introduction to telemedicine: 08hrs(12mks) Definition of Telemedicine, Telehealth and Telecare, Types of Telemedicine: Teleconsultation, Tele-education, Telemonitoring, Telesurgery. network connection from human body to the outside world, basic requirements of telemedicine : sensors, cameras, actuators, communication network (definitions only), Benefits and Limitations of Telemedicine.</p>
<p>UNIT 2: Communication Networks and Services : 13hrs(19mks) Wireless communication basics, wired and wireless networks (difference only), Conducting and optical cable (difference only). Data transmission speed : bandwidth, baud (definitions), electromagnetic interference, modulation : AM and FM(definitions), OSI model.</p>
<p>UNIT 3: Types of Telemedicine Information & Wireless Networks : 07hrs(12mks) Types of Telemedicine Information, Text and Data ,Audio ,Still Images, Video. Bluetooth, infrared, wireless local area networks (WLAN) and Wi-Fi, cellular networks, broadband wireless access (BWA), satellite networks.</p>
<p>UNIT 4: Wireless Technology in Patient Monitoring :07hrs(12mks) Body area network, emergency rescue, block diagram of Medical information system, Bio signal transmission and processing, block diagram for collecting patient's information.</p>

UNIT 5: Biotelemetry :	13hrs(20mks)
Introduction, single channel radio telemetry system for ECG :	
Transmitter and receiver, multi channel radio telemetry system using	
FDM and TDM : Transmitter and receiver.	

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

Unit No	Name of the Unit	Teaching Hours/ Semester	Marks
1	Introduction to telemedicine	08	12
2	Communication Networks and Services	13	19
3	Types of Wireless Networks	07	12
4	Wireless Technology in Patient Monitoring	07	12
5	Biotelemetry	13	20

5. SUGGESTED LIST OF EXPERIMENTS

Sr. No	LIST OF EXPERIMENTS
1	Study of applications of Telemedicine in Health care delivery.
2	Study of types of Networking.
3	Study of various Biomedical Sensors.
4	Study of a simple Emergency Rescue.
5	Study of Mobile Telemedicine.
6	Study of Patient Information Collection.
7	Mini Projects

6. SUGGESTED LEARNING RESOURCES

Sr.No	Author	Title	Publication and Year
1	Bernard Fong A.C.M.Fong C.K.Li	Telemedicine Technologies (Information Technologies in Medicine and Telehealth)	Wiley A John Wiley & Sons, Ltd, Publication 2011
2	A. C. Norris	Essentials of Telemedicine and Telecare	John Wiley & Sons Ltd 2001

(MX614) PRINCIPLES AND PRACTICES OF LABORATORY MEDICINE

1. RATIONALE

This course will enhance students to study and gain knowledge of pathological techniques. The training under the units is imparted to enable the students to know the principle of tests, methodology of routine as well as advanced procedures being carried out in the laboratory. Stress is also given in use of safety measures in the laboratory.

2. TEACHING AND EXAMINATION SCHEME:

Course Code & Course Title	Periods/ Week (In Hours)			Total Credit	Examination Scheme				Total Marks
					Theory Marks		Practical Marks		
	L	T	P	C	TH	TM	TW	PR/OR	
MX614 PRINCIPLES AND PRACTICES OF LABORATORY MEDICINE	3	-	2	5	75	25	25	25	150

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

Legends:

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

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

3. DETAILED COURSE CONTENTS

Unit-I GENERAL PATHOLOGY (3 hrs)(6 marks)

- 1.1 Introduction of pathology
- 1.2. Cellular structure and metabolism
- 1.3 Inflammation – Acute and Chronic
- 1.4 Derangement of Body Fluids and Electrolytes - Types of shocks, Ischaemia , Infection
- 1.5 Neoplasia – Etiology and Pathogenesis

Unit-II HAEMATOLOGY (10hrs) (14 marks)

- 1.1 Introduction of hematology --- Formation of Blood , Erythropoiesis , Leucopoiesis , Thrombopoiesis , Collection of Blood , Anticoagulants, Red cell count – Haemocytometer, Methods and Calculation , WBC Count – Methods , Differential Leucocytes Count (DLC) – Morphology of White Cells, Normal Values
Romanowsky’s Stains : Staining procedures Counting Methods, Principle of staining , Hb estimation Method - Colorimetric Method ,Drabkin’s Method ;,Clinical Importance .
- 1.2 Methods of determination of PCV.
- 1.3 Calculation of different red cell indices (Haemogram)
- 1.4 Basic principles of semi or automated blood cell counters
- 1.5 Erythrocyte sedimentation rate (Procedure & reading only).
- 1.6 Basic tests for coagulopathy – BT, CT, P time, APTT.

1.7 Basic concepts of anaemia, Leukemia and hemorrhagic disorder

Unit-III BIOCHEMISTRY (12hrs) (16marks)

2.1 Collection, Separation, preservation and transport of the biological specimens, anticoagulants.

2.2 Clinical laboratory instrumentation (Balance, Oven, Water bath)

2.3 Principles of Photometry, (Lambert-Beer's Law, Flame photometry, Turbidometry), Colorimeter principles and functions

2.4 Chemistry of Carbohydrates, Lipids, Amino Acids and Proteins.

2.5 Clinical Enzymology - Definition of enzyme, classification with examples, types of enzyme-substrate

reactions, assay of enzymes. End point & Kinetic, clinical importance of enzymes, (isoenzymes.)

2.6 Liver Function Tests - Overview of anatomy & physiology of Liver, bilirubin metabolism, jaundice & its biochemical diagnosis).

2.7 Renal Function Tests - Overview of anatomy & physiology of Kidney, Clearance Tests, other biochemical

tests for detection of the renal function i.e. Serum creatinine, urea, sodium, potassium, urinary micro

albumin and 24 hours protein estimation in urine, urinary osmolarity).

2.8 Estimation of Glucose, Total protein, Albumin, Globulin, A/G Ratio, Estimation of important enzymes -

SGOT (AST), SGPT (ALT), Alkaline Phosphatase, Acid Phosphatase, Amylase, lactate dehydrogenase.

CPK, CPK-MB, lipids-, total lipids, HDL, LDL, VLDL, total cholesterol, triglyceride, essential electrolytes-

sodium, potassium, calcium, chloride, phosphorus.

Unit-IV SEROLOGY (05hrs) (8 marks)

3.1 Antigens & Antibodies – definition, types, preparation & preservation.

3.2 Types of Antigen and Antibody reactions. Detection of Antigen-Antibody reactions (ELISA, RIA)

3.3 Diagnostic serological methods – Agglutination & Flocculation, Latex agglutination tests – to be performed

by the students, Elisa testing & RIA – principles and demonstration and interpretation of results of - Widal

test, VDRL Test, Aldehyde Test, ASO Titre, Rheumatoid factor, C-reactive protein, HBsAg, Anti HCV, Anti

HIV.

Unit-V CLINICAL PATHOLOGY (05hrs) (8marks)

- 4.1 The Microscope – different types, parts of microscope, cleaning & care.
- 4.2 Examination of Urine – Formation of urine
Physical examination – Colour, transparency, pH and Sp gravity.
Chemical examination - Protein, Sugar, Ketone bodies, Bile pigment/salt, Chyle, Blood.
Microscopical examination – Cells (RBC, WBC, Epith), casts, crystals, Detection of microalbumin & 24 hours urine protein estimation.
- 4.3 Examinations of body fluids – CSF, Pleural, peritoneal & pericardial fluid, Bronchoalveolar lavage fluid, hydatid cyst fluid, Joint fluid.
- 4.4 Examination of Semen – physical characters, count, motility, viability and morphology
- 4.5 Transportation of different clinical materials to distant laboratories.

Unit-VI CYTOTOPOLOGY AND HISTOLOGY (06hrs) (9 marks)

- 5.1 Fixation of tissue-different fixatives and their mode of action.
- 5.2 Methods of decalcification.
- 5.3 Processing of tissues-protocol for manual & automated tissue processors, paraffin embedding & preparation of blocks, preparation of reagents, different techniques & application and frozen Section/cryostat.
- 5.4 Use of Microtomes, selection and maintenance of knives, technique of section cutting & mounting on slides.
- 5.5 Staining of tissue sections, preparation of different stains, staining methods for Haematoxylin & Eosin, (Reticulin, PAS, Van-Gieson, Massion's trichrome, Lipid & Mucin stains & Perl's stain...not to be evaluated)
- 5.6 Preparation of cytosmear and H&E, Papanicolaou & MGG staining of different body fluids.
- 5.7 Fine Needle Aspiration cytology & exfoliative cytology & Buccal Smear examination.

Unit VII MICROBIOLOGY (04hrs) (8marks)

- 6.1 Physiology and growth requirements.
- 6.2 Sterilisation – principles & different methods adopted.
- 6.3 Preparation of culture media
- 6.4 Bacterial staining – Gram/Ziehl-Neelsen, Principle and procedure
- 6.5 Methods of colony count & morphological identification of bacteria by colony characters, staining & motility tests.
- 6.6 Biochemical tests and interpretation.
- 6.7 Final identification of bacteria with High-titre sera
- 6.8 Antibiotic sensitivity tests.

- 6.8 The microbial world and the structure of microbes.
 6.9 Collection of specimens for microbiological examination.
 6.10 Methods of inoculation of culture media from different samples.
 6.11 Basic concept of individual Bacteria.
 6.12 Principle & procedure of Serological Tests. • BIDAL, CRP, Brucella, Agglutination, ASO • Cold agglutination, VDRL, TPHA
 i) Advanced techniques in Microbiology ELISA, RIA etc
 ii) Epidemiological Markers of Micro-organism serotyping
 iii) Preparation & Standardization of Antigen and Antisera
 iv) Preparation & Standardization of vaccine and immunization

Unit VIII LABORATORY METHODS (03 hrs) (6 Marks)

- 7.1 Reception of patients, noting carefully the test advised, phlebotomy and aftercare of patients.
 7.2 Basics of quality control methods and Laboratory accreditation. Basic concept of quality control in clinical biochemistry laboratory. (Control material, Levey Jennings Plot.
 7.3 Laboratory hazards, Biosafety measures and disposal of laboratory waste.
 7.4 Basic concept of laboratory automation. (Configuration of clinical laboratory analyzers).
 7.5 Basic concept of laboratory statistics. (Reference value, mean, median, mode, standard deviation, Co-efficient of variation.)

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

Unit No.	Unit	Teaching Hours / Semester	Marks
1	GENERAL PATHOLOGY	03	06
2	HAEMATOLOGY	10	14
3	BIOCHEMISTRY	12	16
4	SEROLOGY	05	08
5	CLINICAL PATHOLOGY	05	08
6	CYTOPATHOLOGY AND HISTOPATHOLOGY	06	09
7	MICROBIOLOGY	04	08
8	LABORATORY METHODS	03	06

Legends: R = Remembrance; U= Understanding; A= Application and above levels

5. SUGGESTED LIST OF EXPERIMENTS

Visits to Hi-tech diagnostic laboratories to see the working of latest equipment

Note: - During the visits the students are required to collect information and also collect the literature available on the advanced pathological techniques. The collection of the same is to be compiled and submitted as Term Work

Sr. No.	LIST OF EXPERIMENTS
1	Collection of Sample ,Hb estimation , TLC and DLC , RBC Count
2	Urine, Stool, Semen and C.S.F.– Collection, Handling, Examinations
3	Absolute Eosinophil Count, PCV, RBC indices, ESR Estimation, Platelet Count
4	Staining – Type of Staining, Principal, Procedure and Interpretation
5	Method of estimation of glucose : Benedicts Reaction, Glucose oxidase
6	Staining : ZN Staining of M. T. B. and M. Lepra,
7	Culture : Type of Media , Preparation , Inoculation, Colony Characteristic , Staining and Antibiotic Sensitivity
8	Viva and diagrams of Corpuscles
9	Method of estimation of urea
10	Method of estimation of Creatinine
11	Method of estimation of Cholesterol
12	Demonstration : Slide Agglutination <ul style="list-style-type: none"> • VDRL • VIDAL • ASO • CRP • Stool Examination • Physical • Microscopic Demonstration of Ova, Cyst, Pus Cells • Hanging Drop Examination

6. SUGGESTED LEARNING RESOURCES

Sr.No.	Author	Title	Publication and Year
1.	Kanai Mukherjee	Medical laboratory Technology I,II,III	Tata NC Growhill 1988
2	Chakravarti&Bhattacharya	A hand book of clinical pathology	Academic Publications New Delhi 1978
3.	K N Sachdev	Viva Voca in Pathalogy,Bacteriology and Haematology	J.P.B Publication 1980
4	P Godkar	Text Book of Medical laboratory Technology	Latest
5	RamnikSood	Medical laboratory Technology	Latest

(ME617) MODERN MARKETING MANAGEMENT

1. RATIONALE

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

2. TEACHING AND EXAMINATION SCHEME

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

Minimum passing % : Theory 40% and Practical 40%

Duration of Theory Paper: 3 Hrs.

3. COMPETENCY TO BE DEVELOPED THROUGH THIS COURSE

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

4. DETAILED COURSE CONTENT

<p>Unit 1 Fundamentals of Marketing Management</p> <ul style="list-style-type: none"> - Define: marketing, market and marketing management - Explain simple model of marketing process - Understand various stakeholders of business: customers, employees, shareholders, society, government, suppliers, distributors , etc - Marketing Management orientations:- Discuss :(a) production concept (b) the product concept (c) the selling concept (d) the marketing concept (e) the societal marketing concept - Building customer relationships: Definition of Customer relationship management (CRM), importance of CRM, customer value and customer satisfaction - Discuss about Customer loyalty programs and customer retention programmes with few examples - Importance of retaining existing customer v/s acquiring new customer - Changing nature of customer relationship in modern times: discuss with examples (a)selective relationship management (b) long term relationships (c)relating directly
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- Importance of ethics and social responsibility while marketing
- discuss the growth of not-for-profit marketing with examples

Unit 2 Marketing segmentation, Targeting, Positioning and Marketing Mix

- Discussion on segmentation based on (a)geographic factors (b) demographic factors (c) psychographic factors (d) behavioral factors. Explain with real world examples.
- Definition of target marketing. Brief discussion on target marketing with examples.
- Understand the concept of Market Positioning with examples from corporate world
- Marketing Mix: discuss in detail, with examples, the four P's of marketing.
- Marketing Environment: discuss in detail, with examples, (a)Political environment, (b)economic environment, (c) social environment, (d) technological environment and (e) natural environment

Unit 3 Marketing research

- Definition and scope of Marketing research
- discuss various steps involved in marketing research
 - (a) defining the problems and research objectives
 - (b) developing the research plan
 - (c) gathering and analyzing the data
 - (d) interpreting and reporting the findings
- Brief discussion on gathering of secondary data and primary data
- Research approaches for gathering primary data, which shall include: observational research, survey research, marketing research and online marketing research.

Unit 4 Consumer Behavior

- Discuss, with examples or case studies, various factors influencing consumer behavior: Cultural factors, social factors, personal factors, psychological factors.
- Discuss in detail ,with examples, following types of buying decision behavior:
 - (a) Complex buying behavior
 - (b) Dissonance –reducing buying behavior
 - (c) Habitual Buying behavior
 - (d) Variety seeking buying behavior

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

Unit 5 Business to Business Marketing (Industrial Marketing)

- Define business markets and explain how business markets differ from consumer markets.
- Discuss buying situations in industry- straight rebuy, new task, modified rebuy.
- Discuss in detail “buying centers”
- Major influences on Business buyers

Unit 6 Product , Services and Branding

- Difference between product and services
- Classification of products: consumer products and industrial products
- Product life cycle and various stages involved in it
- Discuss in brief product and service decisions: product attributes, branding, packaging, and labeling and product support services.
- Branding Strategy: Brief introduction to brand positioning, brand name selection, brand sponsorship and brand development.

Unit 7 Marketing Channels (Distribution Channels)

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

Unit 8 Sales Management

- Discuss functions of salespeople: Prospecting, targeting, communicating, selling, servicing, information gathering, allocating
- What makes a good sales representative
- Understand in detail various steps in selling process: Prospecting and qualifying, pre approach, approach, presentation and demonstration, handling objections, closing, follow-up
- Direct Marketing:
 - Definition and concept of direct marketing
 - Benefits and growth of direct marketing
 - Use of customer database in direct marketing
 - Forms of direct marketing: telephone marketing, direct mail marketing, catalog marketing, direct response television marketing, kiosk marketing
 - Ethical issues in direct marketing: (a) Irritation, unfairness, deception and fraud (b) Invasion of privacy, etc.

Unit 9 Marketing in the digital age

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

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

-Understand benefits of E-commerce to the buyers

- Understand benefits of E-commerce to the sellers

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

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

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

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

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

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

-Latest trends in digital marketing

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

Unit No.	Topic	Teaching Hours/ Semester	Total Marks
1	Fundamentals of marketing management	5	9
2.	Marketing segmentation, targeting , positioning and marketing mix	9	12
3.	Marketing research	5	6
4.	Consumer behavior	5	6
5.	Business to business marketing (Industrial Marketing)	3	6
6.	Product, services and branding	4	6
7.	Marketing Channels	3	6
8.	Sales Management	8	12
9.	Marketing in the digital age	6	12
	Total	48	75

6. SUGGESTED LIST OF EXPERIMENT

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

Reference books: -

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

(EN611) PROGRAMMABLE LOGIC CONTROLLER

1. RATIONALE

With the advancements in ELECTRONICS, PROGRAMMABLE LOGIC CONTROLLERS (PLC) are becoming more and more popular in Industrial Automation; Therefore this course will help the students in understanding the fundamentals of PLC & also to develop some basic skills to use PLC in various applications.

2. TEACHING AND EXAMINATION SCHEME

Course Code & Course Title	Periods/ Week (In Hours)			Total Credits	Examination Scheme				Total Marks
					Theory Marks		Practical Marks		
EN611 PLC	L	T	P	C	TH	TM	TW	PR/OR	150
	3	-	2	5	75	25	25	25	

Minimum passing %: theory 40%, Duration of the theory papers: 3 hours

L: Lectures, T: tutorials, P: Practical, C: Credit, TH: end semester theory, TM: Test Marks, TW: term work, PR/OR: End Semester Practical/Oral Exam,

3. DETAILED COURSE CONTENT

Unit	Topics and Sub-topics
<p>Unit - I</p> <p>PLC HARDWARE</p>	<p>7. Introduction: definition, features, advantages, applications</p> <p>8. PLC system: PLC forms – single box, modular, functional diagram, processor section (detailed block diagram)- power supply, memory, CPU, buses, input/output section – I/O interface, I/O channels – isolation and signal conditioning, I/O voltage and current levels, sourcing & sinking</p> <p>9. Input and Output units: Types of input/output signals – analogue, discrete, digital</p> <p>Input units: DC input unit, AC input unit, analogue input unit</p> <p>Output units: basic forms of relay, transistor and triac output units</p> <p>interfacing processor with I/O modules</p> <p>10. I/O addresses</p>
<p>Unit -II</p> <p>PROGRAMMING a PLC</p>	<ul style="list-style-type: none"> ▪ Programming Languages- Ladder diagrams(LAD), ▪ PLC Ladder programming: ladder diagram – conventions, standard IEC 1131-3 symbols, ladder diagrams to represent logic functions (AND, OR, NOT, NAND, NOR, XOR), ladder diagrams for latching circuits, multiple outputs, sequenced outputs; ▪ Ladder diagrams and functional block diagrams from boolean expressions

Directorate of Technical Education, Goa State

	<ul style="list-style-type: none"> ▪ Program examples ▪ Subroutine: call to subroutine, return to main program, example ▪ Data handling: data handling instructions – data movement, data comparison ▪ Arithmetic functions – arithmetic operations
Unit -III TIMERS & COUNTERS	6. Timers: Function, types of timers with application –on-delay timers, off-delay timers, pulse timers, cascaded timers, programming timers, programming example 7. Counters: function, up & down counters, programming counters, counter application
Unit -IV INTERNAL RELAYS & SHIFT REGISTERS	<ul style="list-style-type: none"> ▪ Internal Relays: Introduction, function. Addressing internal relays, ladder programs for internal relays, battery backed relays, master control relay ▪ Shift registers: Introduction, function, representation in ladder program, application example
Unit -V DESIGNING SYSTEMS	<ul style="list-style-type: none"> ▪ Brief overview, steps in systematic designing ▪ Safety PLCs – emergency stop relays ▪ Commissioning a PLC – testing inputs & outputs, testing software, simulation ▪ Fault finding : fault detection techniques – timing checks, last output set, replication, expected value checks • System documentation (brief overview)

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

Unit No.	Topic	Teaching Hours/ Semester	Marks
1	PLC hardware	10	18
2	Programming a PLC	14	21
3	Timers & counters	08	12
4	Internal relays & shift registers	08	12
5	Designing systems	08	12
	<i>Total</i>	48	75

5. SUGGESTED LIST OF EXPERIMENTS

S. No.	Experiment
1	To identify different hardware of a PLC system (field visits)
2 to 9	Ladder programming for the following functions a) Logical b)Latching c) Data manipulation d) Arithmetic e) Timers f)Counters g) Relays h)Shift registers
10	Project (one simple application)

6. SUGGESTED LEARNING RESOURCES

S.No.	Title of Book	Author	Publication
1	PLC & Industrial Automation	MadhuchhandaMitra, SamarjitSengupta	Penram Intl
2	Programmable Logic Controllers: Principles and Applications	John W. Webb, Ronald A. Reis	Prentice Hall of India, New Delhi, 2002, 5 th edition, ISBN :978-8120323087
3	Programmable Logic Controllers.	Frank Petruzellla	Tata McGrawHill.
4	Programmable Logic Controllers.	George Batten	Tata McGrawHill.
5	Programmable Logic Controller	S.BrianMorriss	Pearson,1999 ISBN-13: 780130955654
6	Introduction to Programmable Logic Controllers	Garry, Dunning	Cengage Learning New Dellhi ISBN: 813150302X

(EN612) INTERNET TECHNOLOGY AND WEB DESIGNING

1. RATIONALE:

The course will enable the students to understand the basics of internet and various applications of internet. This course develops competency among the students to design professional websites and interactive web pages. They will have an overview of different technologies like HTML, CSS, JavaScripts, and PHP.

2. TEACHING AND EXAMINATIONS SCHEME:

Course Code & Course Title	Periods/ Week (In Hours)			Total Credit	Examination Scheme				Total Marks
					Theory Marks		Practical Marks		
EN612 INTERNET TECHNOLOGY AND WEB DESIGNING	L	T	P	C	TH	TM	TW	PR/OR	150
		3	-	2	5	75	25	25	

3. DETAILED COURSE CONTENTS:

UNIT 1

11. TCP/IP Model (15 marks)

1. Layers in TCP/IP Model
2. TCP/IP Protocol Suite (Protocols associated with the layers of TCP/IP Suite - **definitions only**)
 - 1.2.1 Physical and Data Link layers
 - 1.2.2 Network Layer (protocols: IP, ARP, RARP, ICMP)
 - 1.2.3 Transport Layer (protocols: UDP, TCP, SCTP)
 - 1.2.4 Application Layer (protocols: HTTP, BOOTP, DHCP, DNS, FTP, SMTP, POP, IMAP, TELNET)
3. Network Layer Protocols
 - 1.3.1 Overview of Internet Protocol
 - 1.3.1.1 IP Addresses in Classful Addressing Scheme
 - 1.3.1.1.1 Dotted Decimal Notation
 - 1.3.1.1.2 Loopback Address

1.3.1.1.3 IP Multicast Addresses

1.3.1.1.4 Drawbacks of Classful Addressing

1.3.1.2 IP version 6

1.3.1.2.1 Limitations of IP version 4

1.3.1.2.2 Features of IP version 6

1.3.1.2.3 IPv6 Packet Format (General Format Only)

1.3.2 Address Resolution Protocol

1.3.2.1 Resolution through Dynamic Binding (Using ARP)

1.3.2.2 Address Resolution Cache

1.3.3 Reverse Address Resolution Protocol

1.3.4 Internet Control Message Protocol

1.3.4.1 Error Reporting by ICMP (Destination Unreachable, Source Quench, Redirect, Time Exceeded)

1.3.4.2 ICMP Message Delivery

1.4 Transport Layer Protocols

1.4.1 Transmission Control Protocol

1.4.1.1 Features of TCP

1.4.1.2 Understanding the TCP Connection (Establishing, Terminating and Resetting a TCP Connection)

1.4.2 User Datagram Protocol

1.4.2.1 Basics of UDP

1.4.2.2 UDP Packet Format

UNIT2

12. Application Layer Protocols and World Wide Web (15marks)

1. Dynamic Host Configuration Protocol

1. Features of DHCP

2. Domain Name System

1. Domain Name Server (Hierarchical namespaces, DNS namespaces, Name servers, Domain Name Resolution, Domain Names)

2. Concepts used in a Domain Name System (Domain, Zones, Root server, Resolver)
3. File transfer and Access Using FTP and TFTP
 1. Understanding FTP
 2. FTP Process Model
 3. Trivial File Transfer Protocol
4. Electronic Mail
 1. Conceptual Components of an E-mail System
 2. Email address format
 3. Protocols used for providing services to email messages (to be covered in brief)
 1. Simple Mail Transfer Protocol
 2. Post Office Protocol
 3. Internet Message Access Protocol
 4. Multipurpose Internet Mail Extension
5. Basics of world wide web (**introduction - reference book 2**)
6. Hypertext Transfer Protocol
 1. Understanding Uniform Resource Locator (URL)
 2. Understanding HTTPcommands(GET,HEAD,PUT,POST,DELETE,LINK,UNLINK)
7. Search Engine Basics (**reference book 3**)

UNIT3

3 Introduction to Web Technology (15 marks)

3.1 The concept of a tier

3.1.1 1-tier application

3.1.2 2-tier application

3.1.3 3-tier application

3.2 Comparison of Microsoft and Java Technologies

3.2.1 Introduction (presentation tier, business tier, database tier)

3.2.2 Presentation Tier Technologies

3.2.3 Business Tier Technologies

3.3 Web Pages – Types (static, dynamic, active) and Issues

3.3.1 Static Web Pages

3.3.1.1 Introduction

3.3.1.2 Advantages and Disadvantages

3.3.2 Plug-ins

3.3.3 Dynamic Web Pages

3.3.3.1 Need for Dynamic Web Pages

3.3.3.2 Introduction

3.3.3.3 Overview of Dynamic Web Pages

3.3.3.4 Overview of Dynamic Web Page Technologies

3.3.3.4.1 Server-side scripting (Active Server Pages (ASP), Java Servlets and Server Pages (JSP) and common gateway interface(CGI) - **brief introduction to these technologies**)

3.3.3.4.2 Client-side scripting (VBScript, JavaScript - **brief introduction to these technologies**)

3.3.4 Active Web Pages

3.3.4.1 Introduction

3.3.4.2 Advantages

3.3.4.3 Overview of Active Web Page Technologies

(Java applets, ActiveX controls - **brief introduction only**)

UNIT4

4 HTML

(15marks)

4.1 Introduction to HTML

4.1.1 HTML Tags (Container tag, Standalone tag)

4.1.2 HTML Page Structure (Head and Body)

4.1.3 Document Structure Tags (<HTML>, <HEAD>, <BASE>, <META>, <LINK>, <SCRIPT>, <TITLE>, <BODY>)

4.2 Formatting Tags

4.2.1 Text Formatting Tags (, <BASEFONT>, <BIG>, , <I>, <STRIKE>, <SMALL>, <SUB>, <SUP>, <U>)

4.2.2 Block Formatting Tags (
, <DIV>, <HR>, <H1>....<H6>, <P>)

4.3 List Tags

4.3.1 List Item - tag

4.3.2 Ordered List - tag (Attributes - Start, Type)

4.3.3 Unordered List - tag (Attributes - Type)

4.3.4 Definition List - <DL> tag

4.4 Hyperlink - <A> tag (Attributes – Href, Name, Target)

4.5 Image tag (Attributes – Src, Alt, Width, Height, Border)

4.6 Table

4.6.1 Introduction to HTML tables and their structure

4.6.2 The Table tags (<TABLE>, <CAPTION>, <THEAD>, <TFOOT>, <TBODY>, <COLGROUP>, <COL>, <TR>, <TD>, <TH>)

4.6.3 Attributes of <TABLE> tag (border, bordercolor, cellpadding, cellspacing, width, height, bgcolor, background, align, hspace, vspace, frame)

4.6.4 Attributes of <TR> tag (align, valign, bgcolor, background, bordercolor)

4.6.5 Attributes of <TD> tag (align, valign, width, height, colspan, rowspan, bgcolor, background, bordercolor)

4.6.6 Spanning multiple rows and columns(colspan, rowspan)

4.7 Frames

4.7.1 Application of frames

4.7.2 Frames Document

4.7.3 The <FRAMESET> tag

4.7.4 Nesting <FRAMESET> tag

4.7.5 Placing content in frames with the <FRAME> tag (Attributes - src, name, scrolling, noresize, frameborder, bordercolor, marginwidth, marginheight)

4.7.6 Targeting named frames

4.7.7 Creating Floating Frames - <IFRAME> tag (Attributes – align, height, width, name, src, frameborder)

4.8 Forms

- 4.8.1 Creating Forms - The <FORM> tag (Attributes – url, method, name, target, onSubmit, onReset)
- 4.8.2 Form Elements
 - 4.8.2.1 The Input Tag (Attributes – type, name, value, size, maxlength, checked, disabled, readonly)
 - 4.8.2.2 Single line text field, text area (multiline input - <textarea>), password, submit button, reset button, radio-buttons, checkboxes, list boxes (<select> and <option> tags)
- 4.8.3 Grouping Related Fields (<fieldset> and <legend> tags)
- 4.8.4 Passing form data (method and action attribute of <form> tag)
- 4.9 Multimedia (<embed> tag)

UNIT5

(15marks)

5. CSS and JavaScript

5.1 Basics of CSS3

- 5.1.1 Understanding the Syntax of CSS
- 5.1.2 Inserting CSS in an HTML Document (internal style sheet, external style sheet, inline style)

5.2 CSS3 Selectors (universal selector, type selector, class selector, id selector, attribute selector)

5.3 Typography

- 5.3.1 Font properties in CSS (font-family, font-size, font-size-adjust, font-stretch, font-style, font-variant, font-weight, font)
- 5.3.2 Introducing Web Font

5.4 Textformattingproperties,borderproperties

5.5 CSS color Modes

- 5.5.1 Opacity Property
- 5.5.2 RGBA Value format
- 5.5.3 HSL and HSLA Values Format
- 5.5.4 Using Color Properties

5.6 Stunning Aesthetics with CSS3

5.6.1 Using the text shadow property

5.6.2 Gradient Properties

5.6.3 Background of a Web Page

5.7 CSS Transitions

5.8 CSS Transformations

5.9 CSS Animations

5.10 JavaScript concept, Origin of JavaScript, Advantages of java script, Java script syntax.

5.11 Variables, Data Types, Operators, Literals

5.12 JavaScript Control Statements

5.13 Arrays and Functions

5.14 DialogBoxes

5.15 Introduction to Objects (object definition, properties, methods)

5.16 Core JavaScript built-in objects

5.16.1 Dateobject (getDate(), getDay(), getFullYear(), getHours(), getMinutes(), getMonth(), setDate(), setFullYear(), setHours(), setMinutes(), setMonth())

5.16.2 Mathobject (max(x,y,z,....,n), min(x,y,z,....,n), pow(x,y), round(x), sqrt(x))

5.16.3 Stringobject (charAt(), concat(), indexOf(), lastIndexOf(), slice(), toUpperCase(), toLowerCase())

5.16.4 Arrayobject (concat(), reverse(), sort(), push(), pop())

5.17 Events and Event Handlers

5.17.1 General information about events

5.17.2 Defining event handlers (onclick(), onload(), onsubmit(), onreset())

4. SUGGESTED LEARNING RESOURCES

List of Textbooks

Sr No	Title of Book	Author	Publication
1	Internet Technologies	Kogent Learning Solutions Inc.	Dreamtech Press
2	Web Technologies	AchyutGodbole AtulKahate	Tata Mcgraw Hill
3	Advanced Internet Technology	Deven Shah	Dreamtech Press
4	WebtechnologyandDesign	C.Xavier	
5	Web Enabled Commercial Application Development Using HTML, JavaScript, DHTML and PHP, 4th Edition 2010	Ivan Bayross	Paper Back ISBN : 9788183330084

List of Software/Learning Websites

1. <http://www.html.net>
2. <http://www.w3schools.com>
3. <http://www.tutorialpoint.com>
4. <http://www.homeandlearn.co.uk>

Suggested List of Practicals

Sr. No	Practical Exercises
1	Write HTML codes for displaying image and demonstrate hyper linking.
2	Write HTML codes to attach video on webpage using embed tag in html
3	Create a Feedback Form Using Form handling.
4	Create a Contact Form using form handling.
5	Write a code for creating static page design using division tag
6	Write a code for design menu system using list tag
7	Design Google Page using HTML
8	Apply CSS formatting to created pages

(EN613) ADVANCED MICRO CONTROLLERS

1. Rationale:

The study of embedded systems is essential part of Computer Science. It deals with computer hardware with software embedded in it. This subject will enable student to develop logical thinking and use of “Firmware”. It is practical oriented subject having theoretical prerequisites of Microprocessor, Digital Techniques, Data Structures and Computer Architecture. Students will be able to develop Real Time Systems, Device drivers, use interrupt service mechanism, program timing and counting devices and develop embedded C-Programs for Microcontroller.

2. Teaching and Examination Scheme:

Course Code & Course Title	Periods/ Week (In Hours)			Total Credits	Examination Scheme				Total Marks
					Theory Marks		Practical Marks		
	L	T	P	C	TH	TM	TW	PR/OR	
EN613 Advanced Microcontroller	3	-	2	5	75	25	25	25	150

3. DETAILED COURSE CONTENT

Chapter	Name of the Topic	Hours	Marks
01	8051 I/O Ports & Interrupts 8051 Parallel I/O Ports Interrupt handling & programming : concept of synchronous & asynchronous interrupts, ISR, programming external hardware interrupt & Timer interrupt.	08	16
02	Introduction to Communication Protocol Serial Communication – Study of SBUF, SMOD, SCON, PCON registers & programming for serial communication. Introduction of RS-232, Study of RS-232 Pinout Serial protocols: I2C, CAN, Fire wire, USB introduction & Comparison	12	20
03	Embedded System	06	10

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	Software & Hardware development tools , IDE, Compiler, Debugger, Simulator, Emulator, In circuit Emulator(ICE),Target Board, Device Programmer		
04	<p>Interfacing Applications</p> <p>Interfacing of seven segment display & LCD display</p> <p>Interfacing diagram & pin out of LCD (Demonstration & programming in practical session only)</p> <p>Interfacing of Key board, ADC & DAC- interfacing diagram & programming.</p> <p>Interfacing of stepper motor- interfacing diagram & programming</p>	14	20
05	<p>PIC Microcontroller: overview of PIC Microcontroller, 18FXX series, special features , functional block diagram of input output pins, memory organizations, registers</p>	08	9
Total		48	75

4. List of Practical

Students undertaking project based on Microcontroller should perform any 8 practical from the list given.

Students not undertaking Microcontroller based project should perform 9 practical in which practical number 10 & 11(Stepper Motor interfacing & ADC Interfacing) are compulsory.

1. Development and execution of the program for sending data on port lines.
2. Development and execution of the program for arithmetic operation and time delay.
3. Development and execution of the program for input and output operation.
4. Development and execution of the program for interface LEDs to particular port.
5. Development and execution of the program to generate a square wave on port.
6. Development and execution of the program for logical operators and data conversion.
7. Development and execution of the program PWM waveform generation.
8. Development and execution of the program to display a message on LCD (16x2).
9. To write 8051 C program to send “WELCOME” on serial port continuously.
10. Interface Stepper Motor to Microcontroller 8051 and development and execution of the program to run stepper motor.

11. Interface ADC to Microcontroller 8051 and development and execution of the program to display digital equivalent of analog input

12. Interface DAC to Microcontroller 805 and development and execution of the program to generate specified voltage.

5. Learning Resources:

Books:

Sr. No.	Author Title Publisher	Title	Publisher
1	Raj Kamal	Embedded Systems	Tata McGraw Hill
2	Muhammad Ali Mazidi, Janice GillispieMazidi	The 8051 Microcontroller And Embedded Systems	PHI
3	Ajay V Deshmukh	Microcontrollers (Theory And Applications)	Tata McGraw Hill
4	Kenneth J. Ayala	The 8051 Microcontroller	PRI
5	Frank Vahid, Toney Givargis	Embedded System Design: A unified Hardware/Software Introduction	John Wiley
6	David E. Simon	An Embedded Software Primer	Pearson Education

(EN614) E-COMMERCE

1. RATIONALE:

This course will enable the students to understand current and emerging electronic commerce technologies using Internet, managing electronic commerce funds transfer, reinventing the future of business through electronic commerce, etc.

2. TEACHING AND EXAMINATION SCHEME:

Course code & Title	Periods/ week (in Hrs)			Total Credit	Examination Scheme				
					Theory Marks		Practical marks		Total Marks
EN614 E-Commerce	L	T	P	C	TH	TM	TW	PR/OR	
		3	-	2	5	75	25	25	25

3. DETAILED COURSE CONTENTS:

Unit 1

1. **Introduction** **(15 marks)**
 - a. Definition of e-commerce
 - b. Conducting Business online
 - 1.2.1 Direct Marketing, selling and services
 - 1.2.2 Financial and Information Services
 - 1.2.3 Maintenance, Repair and Operations
 - 1.2.4 Value Chain Integration
 - 1.3 Impact of e-commerce on business
 - 1.4 Issues in implementing e-commerce
 - 1.5 Comparison between Traditional Commerce and e-commerce
 - 1.6 Incentives for engaging in E-commerce
 - 1.7 Driving forces behind e-commerce
 - 1.8 Advantages of e-commerce
 - 1.8.1 Primary benefits of E-commerce
 - 1.8.2 Advantages to customers
 - 1.8.3 Advantages to Business
 - 1.8.4 Advantages to society
 - 1.9 Disadvantages of e-commerce
 - 1.10 Electronic market
 - 1.11 Types of e-commerce/e-commerce market models
 - 1.12 Architectural framework for e-commerce
 - 1.13 Applications of e-commerce

Unit 2

▪ **Emergence of E-Commerce** (15 marks)

- 2.1 Electronic transaction process.
- 2.2 Electronic data interchange (EDI).
 - 2.2.1 What is EDI?
 - 2.2.2 Before Implementation of EDI
 - 2.2.3 After Implementation of EDI
 - 2.2.4 EDI basics
 - 2.2.5 EDI in action
- 2.3 EDI standards
- 2.4 Financial EDI.
- 2.5 Applications of EDI.
- 2.6 Benefits of EDI.
- 2.7 Typical EDI systems.

Unit 3

▪ **Electronic payment system (EPS)** (15 marks)

- 3.1A Layered protocol Model
- 3.2 Types of Electronic payment system
- 3.3 Digital token based Electronic payment system
 - 3.3.1 Electronic cash
 - 3.3.1.1 Properties of E-cash
 - 3.3.1.2 How E-cash is generated
 - 3.3.2 Smart card & Electronic payment system
 - 3.3.3 Electronic check (E-Check)
- 3.4 Credit card based Electronic payment system
 - 3.4.1 Payment using Plain credit card
 - 3.4.2 Payment using Encrypted credit card details
 - 3.4.3 Payment using third party verification
- 3.5 Business Pros & Cons of credit cards
- 3.6 SET protocol Algorithm for credit cards
 - 3.6.1 A sample SET session
 - 3.6.2 Objectives of SET

Unit 4

▪ **E- commerce Enterprise** (15 marks)

- Need to set up an E-commerce Enterprise
 - 4.1.1 Competition
 - 4.1.2 Global reach
 - 4.1.3 Customer service
 - 4.1.4 Value addition
 - 4.1.5 Operation oriented processes
 - 4.1.6 Nettish products

- 4.2 Setting up of ecommerce enterprise
 - 4.2.1 Web development and maintenance
 - 4.2.2 Static WebPages
 - 4.2.3 Integration with operational database
 - 4.2.4 Dynamic websites
 - 4.2.5 Customer transactions
 - 4.2.6 Transaction processing
- 4.3 Getting started with ecommerce enterprise
 - 4.3.1 Investments
 - 4.3.1.1 Web hosting and administration
 - 4.3.1.2 Web designing and development
 - 4.3.1.3 Online transactions
 - 4.3.1.4 Marketing and branding
 - 4.3.1.5 Training and development
 - 4.3.1.6 Management and control
 - 4.3.2 Marketing
 - 4.3.3 Growth
 - 4.3.3.1 Market share
 - 4.3.3.2 Geographical reach
 - 4.3.3.3 Product range
- 4.4 How to get customers and retain them
 - 4.4.1 Promotion
 - 4.4.1.1 Online promotional strategies
 - 4.4.1.1.1 Listing on search engines
 - 4.4.1.1.2 Banners
 - 4.4.1.1.3 Link exchange programs
 - 4.4.1.1.4 Affiliate programme
 - 4.4.1.1.5 Referral programs
 - 4.4.1.1.6 Directory listing
 - 4.4.1.2 Traditional promotional strategies
 - 4.4.2 Building trust
 - 4.4.2.1 Branding
 - 4.4.2.2 Navigation
 - 4.4.2.3 Presentation
 - 4.4.2.4 Fulfillment
 - 4.4.2.5 Logos of security
 - 4.4.2.6 Up-to-date technology
 - 4.4.3 Building loyalty

Unit 5

▪ **M-commerce marks)**

(15

- Introduction
- Requirements of a Mobile Commerce System

- Mobile Commerce System Structure
 - Mobile Commerce Applications
 - 5.4.1 Commerce
 - 5.4.2 Education
 - 5.4.3 Enterprise Resource Planning
 - 5.4.4 Entertainment
 - 5.4.5 Health care
 - 5.4.6 Inventory tracking and dispatching
 - 5.4.7 Traffic
 - 5.4.8 Travel and ticketing
- 5.5 Mobile stations
- 5.5.1 Operating system
 - 5.5.1.1 Palm OS
 - 5.5.1.2 Pocket OS
 - 5.5.1.3 Symbian OS
- 5.6 Mobile Middleware
- 5.6.1 WAP
 - 5.6.2 imode
 - 5.6.3 Comparison of WAP and imode

4. REFERENCE BOOKS:

- Business on the Net By Kamlesh Agarwala, Amit Lal, Deeksha Agarwala
- Electronic Commerce By Mukesh Chandra Trivedi
- Mobile Commerce Applications by Nan Si Shi

5. LIST OF EXPERIMENTS

Sr. No	Name of the Experiment
1.	Brief study of various Advantages and Disadvantages of E-commerce (Can include debate , group discussion)
2.	Analysis of any E-commerce website based on following criteria <ul style="list-style-type: none">• User Interface• Product Catalog• Payment options• Search options• Security
3.	Designing a Homepage for E-Commerce Site
4.	Study of E-commerce Enterprise(any one)
5.	Case study of Payment gateway (any one)
6.	Case study of M-commerce Application(any one)

(EN615) CONSUMER ELETRONICS

1. RATIONALE

Many of the domestic and office gadgets at home and around are electronically controlled. This course on Consumer Electronics will enable students to understand the underlying working principles of many of the electronic devices used in the consumer industry. The student will be able to apply this knowledge to carry out maintenance, fault finding repairs and servicing of such devices along with laboratory equipments

2. TEACHING AND EXAMINATION SCHEME

Course Code & Course Title	Teaching Hours/ Week			Total Credits	Examination Scheme				Total Marks
					Theory Marks		Practical Marks		
EN615 Consumer Electronics	L	T	P	C	TH	TM	TW	PR/OR	150
		3	-	2	5	75	25	25	

3. DETAILED COURSE CONTENT

Unit	Topics and Sub-topics
Unit – I Electronically Controlled Low Power Home Appliances	<ul style="list-style-type: none"> • Simple and Scientific Digital Calculator : Block diagram, Working and specifications • Digital Thermometer : Working and feature • Digital Weighing machine : Working and specification
Unit - II Electronically Controlled High Power Home Appliances	Specifications, Working and Electronic control of <ul style="list-style-type: none"> • Refrigerator, • Air Conditioner, • Washing Machine, • Microwave Oven and • Voltage Stabilizer
Unit – III Electronically Controlled Entertainment, Commercial and Surveillance Appliances	<ul style="list-style-type: none"> • Technical specifications, working principle and operation of Digital Camera • Features of typical electronic surveillance system • Technical specifications and working of Burglar Systems: Metal detector: operation and Application Specifications and Working of Photocopier

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Unit – IV Electronically Controlled Communication Appliances	Working and Electronic control of : <ul style="list-style-type: none"> • Cordless Phones, • EPABX systems
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4. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)

Unit No.	Unit	Teaching Hours/ Semester	Marks
1	Electronically Controlled Low Power Home Appliances	10	20
2	Electronically Controlled High Power Home Appliances	12	20
3	Electronically Controlled Entertainment and Surveillance Appliances	18	25
4	Electronically Controlled Communication Appliances	8	10
	Total	48	75

5. SUGGESTED LIST OF BOOKS & OTHER LEARNING RESOURCES

S.No.	Author	Book Title	Publisher
1	Khandpur R.S.	Troubleshooting electronic equipment	Mc. Graw Hill Education India.
2	Homer Davidswon Wilder	Consumer Electronics Component handbook	Mc. Graw Hill Professional
3	Bali S.P.	Consumer Electronics	Dorling Kindersly (India) pvt. Ltd.
4	Homer Davidswon Wilder	Troubleshooting and repairing of Consumer Electronics	Mc. Graw Hill Education India.
5	Kinney Douglas	A beginners guide to Consumer Electronics	Universe

6. SUGGESTED LIST OF EXPERIMENTS

S. No.	Experiment
1	Use of Test and Measurement Instruments and Interpretation of manuals of : CRO, Multimeter, power supply and function generator
2	Identification and Testing of different types of component : Resistors, Capacitors, Diodes, Transistors, Switches and Relays
3	Soldering and Desoldering
4	Trouble shooting of Power Supply
5	Trouble shooting of UPS and SMPS
6	Trouble shooting of Public address System
7	Trouble shooting of Oscilloscope and Function generator
8	Trouble shooting of stereo Amplifier

(IE6) INSTIUTIONAL ELECTIVE**

1. RATIONALE :

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

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

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

2. TEACHING AND EXAMINATION SCHEME :

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

3. DETAILED COURSE CONTENTS :

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