

Maharashtra State Board of Vocational Examination, Mumbai 400 051

1	Name of Course	Certificate Course in Bio-Medical Instrumentation, Radiology & Imaging									
2	Course code	301410									
3	Max no. of Students	25 Students									
4	Duration	2 year									
5	Course Type	Full Time									
6	No. of Days per week	6 days									
7	No. of hours per day	7 Hrs									
8	Space require	Theory Class Room – 240 sqft Three Practical Lab – 3000 sqft									
9	Entry qualification	S.S.C. Pass									
10	Objective of syllabus	1) Awareness of Safety precautions 2) Knowledge of soldering techniques, use of tools in assembly. 3) Knowledge of Engineering Tools 4) Knowledge of electronic component used in Electrical & Electronics Instrument. 5) Knowledge of Radio & Audio Systems. 6) Ability to read schematic layouts / diagrams.. 7) Maintenance of Electrical / Electronics Instruments used in Industry.									
11	Employment opportunities	The trainee will either to be able to take up jobs with agencies which maintain and repair such equipments or with working experience will be in a position to start his own independent Business.									
12	Teachers Qualification	Master Degree in Arts for VTH1,2,3. & For VTH 4, 5, 6 Degree in Electronics Engineering or equivalent profession Qualification. With 1 year Teaching experience in Electronics Field.									
13	Teaching Scheme –										
	Sr.	Subject	Subject Code	Clock Hours / Week					Total		
				Theory		Practical					
	1	English (Communication Skill)	90000001	2 Hrs		1 Hrs		3 Hrs			
	2	Elective – I	--	2 Hrs		1 Hrs		3 Hrs			
	3	Elective – II	--	2 Hrs		1 Hrs		3 Hrs			
	4	Electronics Devices & Circuits	30140001	3 Hrs		8 Hrs		11 Hrs			
	5	Analog & Digital Electronics	30140002	3 Hrs		8 Hrs		11 Hrs			
	6	Bio-Medical Instrumentation, Radiology & Imaging	30140012	3 Hrs		8 Hrs		11 Hrs			
	Total								42 Hrs		
14	Internship	Two Month Summer Internship from 1 st May to 30 th June is Compulsory.									
15	Examination Scheme – Final Examination will be based on syllabus of both years.										
	Paper	Subject	Subject Code	Theory			Practical			Total	
				Duration	Max	Min	Duration	Max	Min	Max	Min
	1	English (Communication Skill)	90000001	3 Hrs	70	25	3 Hrs	30	15	100	40
	2	Elective – I	--	3 Hrs	70	25	3 Hrs	30	15	100	40
	3	Elective – II	--	3 Hrs	70	25	3 Hrs	30	15	100	40
	4	Electronics Devices & Circuits	30140001	3 Hrs	100	35	3 Hrs	100	50	200	85
	5	Analog & Digital Electronics	30140002	3 Hrs	100	35	3 Hrs	100	50	200	85
	6	Bio-Medical Instrumentation, Radiology & Imaging	30140012	3 Hrs	100	35	3 Hrs	100	50	200	85
	Total									900	375
16	Teachers – Three Teachers per batch for vocational component. For English, Elective-I & II guest faculty on clock hour basis.										
17	a) For Elective I – Student can choose any one subject Code Subject Name 90000011 Applied Mathematics 90000012 Business Economics 90000013 Physical Biology (Botany & Zoology) 90000014 Entrepreneurship 90000015 Psychology						b) For Elective II – Student can choose any one subject Code Subject Name 90000021 Applied Sciences (Physics & Chemistry) 90000022 Computer Application 90000023 Business Mathematics				

Subject Name : English (Communication Skill) - 1st Year

(Subject code : 90000001)

1) PROSE

	TOPIC	AUTHOR	
1	SPOKEN ENGLISH AND BROKEN ENGLISH	GEORGE BERNARD SHAW	
2	THE HOMECOMING	RABINDRANATH TAGORE	
3	WHAT WE MUST LEARN FROM THE WEST	N.R. NARAYAN MURTHY	
4	AFTER 20 YEARS	O .HENRY	
5	THE HAPPY PRINCE	OSCAR WILDE	

2) POETRY

1	IF	RUDYAR KIPLING	
2	BABY'S WORLD	RABINDRANATH TAGORE	
3	POISON TREE	WILLIAM BLAKE	
4	PSALM OF LIFE	H.W.LONGFELLOW	
5	HOPE	SIDDHARTH ANAND	

3) GRAMMER

		EXCERCISES
PARTS OF SPEECH NOUNS : KINDS OF NOUNS AND USAGES PRONOUNS PREPOSITIONS ADJECTIVES CONJUNCTION VERB ADVERB INTERJECTION	INTRODUCTION AND EXPLANATION	SENTENCE CORRECTIONS

ARTICLES / APOSTROPHES		
DIRECT /INDIRECT SPEECH		
HOMONYMS/HOMOPHONES		
FIGURES OF SPEECH		
LETTER WRITING – FORMAL AND INFORMAL		
COMPREHENSIONS		
EMAIL AND BUSINESS LETTERS (FORMAT TO BE TAUGHT WHICH IS USED IN WORKPLACE)		
COMPOSITIONS		

4) NON DETAIL

My experiments with truth – M.K.GANDHI

(an autobiography)

5) PRACTICAL

PRACTICALS – 30 MARKS

(BASED ON PERSONAL ENHANCEMENT)(THROUGH SKITS/CHARTS/FLASH CARDS/SKITS/PRACTICAL PROJECT)

OBJECTIVE : GROOMING THE STUDENT TOWARDS HIS CAREER.

AT THE END OF EACH TOPIC, THE STUDENT HAS TO HAVE BENEFITTED FROM IT.

KNOW THYSELF

GOAL SETTING HELP STUDENTS IDENTIFY THEIR OWN GOALS AND THUS LINK TO THEIR CAREERS AS PART OF CURRICULUM

TIME MANAGEMENT

TEAM WORK

INTERPERSONAL COMMUNICATION

GENERAL KNOWLEDGE/ QUIZ BASED ON THEIR SUBJECT

SPOKEN ENGLISH

English (Communication Skill) – 2nd year.

1) PROSE

	TOPIC	AUTHOR	
1	SPEECH AT CHICAGO	SWAMI VIVEKANANDA	
2	THE CASE FOR THE DEFENCE	GRAHAM GREENE	
3	WAITING FOR THE BUDDHA		
4	WATER – THE ELIXIR OF LIFE	C.V.RAMAN	
5	A HORSE AND TWO GOATS	R.K.NARAYAN	

2) POETRY

1	ROAD NOT TAKEN	ROBERT FROST	
2	Even this shall pass		
3	TO INDIA	SAROJINI NAIDU	
4	ALL THE WORLDS A STAGE	WILLIAM SHAKESPEARE	
5	A PRAYER FOR MY MOTHERS BIRTHDAY	HENRY VAN DYKE	

3) GRAMMER

		EXCERCISES
PARTS OF SPEECH NOUNS : KINDS OF NOUNS AND USAGES PRONOUNS PREPOSITIONS ADJECTIVES CONJUNCTION VERB ADVERB INTERJECTION	Different usages on the lines of competitive exams	SENTENCE CORRECTIONS

ARTICLES / APOSTROPHES		
DIRECT /INDIRECT SPEECH		
HOMONYMS/HOMOPHONES		
FIGURES OF SPEECH		
LETTER WRITING – FORMAL AND INFORMAL		
COMPREHENSIONS		
EMAIL AND BUSINESS LETTERS (FORMAT TO BE TAUGHT WHICH IS USED IN WORKPLACE)		
COMPOSITIONS		

4) NON DETAIL

MY EXPERIMENTS WITH TRUTH – M.K.GANDHI

5) PRACTICALS

CAREER CHART.(DEPENDING ON THE STREAM CHOSEN BY THE STUDENT)

ETIQUETTE FOR INTERVIEWS

BODY LANGUAGE

BUSINESS LETTERS

PRESENTATIONS

MARKING SCHEME :

PROSE : 20

POETRY : 15

GRAMMAR : 25

NON DETAIL : 10

PRACTICALS : 30

Elective 1 : Applied Mathematics - 1st Year

(Subject code : 90000011)

Theory	Practical
Detailed Syllabus: 1.0. Trigonometric ratios 1.1. Angles & its measurements 1.2. Trigonometric ratios 1.3. Relation between degree and radian. 1.4. Fundamental identities. 1.5. Examples based on Fundamental Identities 1.6. Trigonometric ratios of compound angles 1.7. Factorization formulae 1.8. Inverse trigonometric functions 1.9. Properties of a Triangle	Detailed Syllabus: Solve problems on: 1) Conversion of radian to degree 2) Conversion of degree to radian
2.0. Plane co-ordinate geometry 2.1. Locus 2.2. Line	
3.0 Vectors and Linear Equalities 3.1. Definition of vector, position vector 3.2. Algebra of vectors (Equality, addition, subtraction and scalar multiplication) 3.3. Dot (Scalar) product with properties. 3.4. Vector (Cross) product with properties. 3.5. Solutions of Linear inequalities in one variable and two variables	
4.0. Determinants and Matrices 4.1. Definition and expansion of determinants of order 2 and 3. 4.2. Cramer's rule to solve simultaneous equations in 2 and 3 unknowns 4.3. Definition of a matrix of order $m \times n$. 4.4. Types of matrices. 4.5. Algebra of matrices such as equality, addition, Subtraction, scalar multiplication and multiplication. 4.6. Transpose of a matrix. 4.7. Minor, cofactor of an element of a matrix, adjoint Of matrix and inverse of matrix by adjoint method. 4.8. Solution of simultaneous equations containing 2 and 3 unknowns by matrix inversion method.	Solve problems on Cramer's rule
5.0 Statistics and Probability 5.1. Measure of dispersion; mean deviation, variance and standard deviation of ungrouped/grouped data. 5.2. Analysis of frequency distributions with equal means but different variances. 5.3. Random experiments: outcomes, sample spaces (set representation). 5.4. Events: occurrence of events, 'not', 'and' and 'or' events, exhaustive events, mutually exclusive events 5.5. Probability of an event, probability of 'not', 'and' & 'or' events.	State and prove Baye's theorem

6.0. Set Relations & Functions 6.1. Types of functions 6.2. Domain, Co – domain, Range of a function 6.3. Composite and Inverse functions 6.4. Graphs of functions	Solve problems on Graphs
7.0. Logarithms 7.1. Introduction and Definition 7.2. Laws of logarithms 7.3. Numerical problems based on multiplication, division and power.	Solve problems on power law
8.0. Complex Numbers and Quadratic equations 8.1. Complex Numbers in the form of $a+ib$ 8.2. Modulus, Complex conjugate, Argument of complex numbers 8.3. Algebra of complex numbers 8.4. Square root of complex numbers 8.5. Argand diagram 8.6. Nature of roots 8.7. Sum and product of roots 8.8. Formation of quadratic equation 8.9. Symmetric functions of roots 8.10. Cube roots of unity	
9.0. Sequences and Series 9.1. Definition of a sequence 9.2. Geometric Progression and Arithmetic Progression 9.3. Arithmetic mean, Geometric mean, harmonic mean 9.4. Special Series	1) Proof of arithmetic progression and geometric progression 2) Proof of arithmetic mean and geometric mean
10.0 Permutations and Combinations 10.1. Factorial notation 10.2. Fundamental principle of counting 10.3. Permutation 10.4. Combinations	
11.0 Mathematical Induction and binomial theorem 11.1. History, statement, Proof of Binomial theorem for positive integral indices, Pascal's triangle, general and middle term in binomial expansion 11.2. Principle of mathematical induction and it's application 11.3. Simple applications	Proof of Binomial theorem

Elective 1 : Applied Mathematics - 2 nd Year

(Subject code : 90000011)

Theory	Practical
Detailed Syllabus : 1.0. CALCULUS: Limits and Continuity 1.1. Definition of a limit 1.2. Algebra of limits 1.3. Standard limits 1.4. Limit at infinity and infinite limits 1.5. Continuity of a function at a point 1.6. Algebra of continuous functions 1.7. Continuity in interval 1.8. Continuity of some standard functions	Detailed Syllabus 1) Theorem on a limit of a sequence 2) Theorem on continuity in interval
2.0. Differentiation 2.1. Derivative using first principle 2.2. Rules of Differentiation	Proof of derivative using the first principle with the help of an example

2.3. Derivatives of standard functions 2.4. Derivatives of logarithmic and exponential functions 2.5. Derivative of composite functions 2.6. Derivative of Inverse functions 2.7. Derivative of implicit and parametric functions 2.8. Second order derivatives	
3.0. Applications of Derivatives 3.1. Geometrical applications 3.2. Derivative as a rate of change measure 3.3. Approximations 3.4. Maxima and Minima	
4.0. Integration 4.1. Definition of an integral of a function 4.2. Integrals of some standard functions 4.3. Rules of integration 4.4. Indefinite Integration 4.5. Definite Integration	Solve problems on definite integration
5.0 Application of Definite Integrals 5.1. Area under the curve 5.2. Volume of solid of revolution	
6.0. Differential equations 6.1. Definition 6.2. Formation of differential equations 6.3. Solution of first order and first degree differential equations 6.4. Applications of differential equations	Solve problems on first order and first degree differential equations
7.0 Numerical Methods 7.1. Definition of various operators and relation between the operators 7.2. Interpolation methods 7.3. Numerical integration	
8.0. Mathematical Logic 8.1. Statements and logical connectives 8.2. Statement Pattern and Logical equivalence 8.3. Application of logic	
9.0. Geometry 9.1. Pair of straight lines passing & not passing through origin 9.2. Circle: definition, Tangent and Normal 9.3. Conic: Equation of Conics 9.4. Three Dimensional Geometry: Direction Cosines and ratios, Line, Plane	
10.0. Linear Programming Problems 10.1. Linear Programming Problems 10.2. Simplex Method	Solve problems on simplex method
11.0. Boolean Algebra 11.1. Boolean Algebra as an algebraic structure 11.2. Principle of Duality 11.3. Boolean function & switching circuits 11.4. Application of Boolean Algebra to switching circuits	State and explain the principle of duality

Elective - I - Business Economics – 1st year

(Subject Code – 90000012)

Theory	Practical
<p>Detailed Syllabus :</p> <p>1. Introduction to Economics –</p> <p>1.1 Meaning & Scope -</p> <p>1.2 Relevance of Economics to different disciplines - Economics & Management, Economics & Law- Economics and Humanities –</p> <p>1.3 Micro Economics and Macro economics</p>	<p>1) Prepare a project on usefulness of micro – economics.</p> <p>2) Prepare a project on usefulness of micro – economics.</p> <p>3) Conduct a GD on the importance of Micro Economics and Macro Economics</p>
<p>2. Macro Economics –</p> <p>2.1 Meaning, Definition and Features.</p> <p>2.2 Aggregates-Nature of Aggregates , problems of Aggregation.</p> <p>2.3 National Income, Meaning, Definition of National Income Different National Income Concepts</p> <p>2.4. Estimation of National Income – Methods and Difficulties</p>	<p>1) Prepare a PPT presentation on macro-economics, National Income and how it is computed and the difficulties in measuring National Income.</p> <p>2) Prepare a chart on the circular flow of National Income.</p> <p>3) Make a comparative study of closed economy and open economy.</p> <p>4) Conduct a case study of 5 individual families and find out the Disposable income to the individuals.</p>
<p>3. Determinants of Aggregates</p> <p>3.1. Aggregate Demand and their components</p> <p>3.2 Aggregate Supply and their components</p> <p>.</p>	<p>Prepare a chart on the components of aggregate demand.</p> <p>Conduct a GD on Keynes theory of employment and principles of effective demand.</p> <p>Take 2 or 3 case studies on entrepreneurship and discuss to what extent they provide employment to people.</p>
<p>4. Money and Banking</p> <p>4.1 Meaning, definitions and functions of Money</p> <p>4.2 Commercial Banks: Meaning and Functions.</p> <p>4.3 Central Banks: Meaning and Functions.</p>	<p>Find out RBIs concept of money supply.</p> <p>A visit to various financial institutions.</p> <p>A visit to a rural bank, cooperative bank, commercial bank.</p> <p>A visit to the RBI Training college, NABARD OR IDBI</p> <p>Further For the first year the practical will consist developing familiarity with banking functions and will comprise Of what are different types of banking services, facilities, available to individuals/organizations? (to increase the financial literacy)</p> <p>how to open a bank account?</p> <p>different investments like – FD,MF</p> <p>facilities for financial inclusion</p>

5 Public Economics 5.1 Government Budget and the Economy Government Budget – Meaning and its components 5.2 Types of Government Budget – Balanced, Surplus and Deficit.	Prepare a report on sources of revenue in the budget of local Government. Comment. Conduct a GD on last year's government budget. Find out how a private budget/ finance differs from public budget/ finance Prepare hypothetical master budget for an imaginary company and discuss how you have allocated the funds for each department. Prepare a separate budget for production, personnel and administration, finance, marketing, advertising, etc.
6. International Trade 6.1 Comparative cost principal of International Trade. 6.2 Free trade Advantages, Disadvantages 6.3 Protectionist trade advantages, Disadvantages	1) Collect data on India's direction of trade 2) Collect data on India's trade Composition
Theory	Practical
Detailed Syllabus : 7.1. Concepts of Economic Growth and Economic Development 7.2 Indicators of Economic Development Monetary indicators 7.3 Human Development indicators	1) To make a project on discrepancies in India's economic growth and development. 2) Discuss the patterns of education among women in the post independence period. 3) Collect information on Human Development Index for different Indian states.
8.0. Structural Changes in the Indian Economy since 1991. 8.1 Economic reforms since 1991: Need and main features, Liberalization, privatization and Globalization. Their impact on Indian Agriculture, Industries and Service Sector. 8.2 Economic Planning – Meaning and Objectives 8.3 Achievements and Failures of 10th Five – Year Plan	1) Conduct a GD on the New Economic Policy, 19991 and its impact on the various sectors. 2) Visit to Agricultural Produce Market Committee to study the price Fixation of agricultural commodities. 3) Collection of market intelligence of agricultural commodities from newspaper and journals. 4) A visit to a cottage industry, small scale industry, large scale industry. 5) A visit to a MNC. Prepare an assignment on the WTO.
9.0. Current Challenges of Indian Economy 9.1 Problem of Population Explosion in India Causes, Effects and Remedial Measures to remove these problems 9.2 Problem of Poverty in India Causes, Effects and Remedial Measures to remove these problems 9.3 Problem of Unemployment in India Causes, Effects and Remedial Measures to remove these problems	Conduct a GD on population explosion and its impact. Prepare a comparative chart on employment in India during the five year plans. Conduct a GD to find out measures for poverty alleviation. Make ppt presentation on population explosion, poverty, unemployment.

10.0. Infrastructural Development in India 10.1 Transport and Communication, 10.2 Energy, 10.3 Health and Education	Prepare a project report on recent trends in communication. Prepare transport documents of trade namely goods forwarding note, lorry receipt, delivery challan, railway receipt, mates receipt, Bill of lading, airway bill, etc. Conduct case studies on different energy companies like Carin India, Power Corporation of India, Reliance Energy, Coal India Ltd. Collect secondary data on health and education.
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Elective - I - Business Economics – 2 nd year

(Subject Code – 90000012)

Theory	Practical
Introduction Micro Economics – 1.1 Meaning, Definition, Nature 1.2 Tools of Analysis, 1.3 Role of Assumptions	1) Conduct a GD on the usefulness of Micro economics 2) Prepare a PPT on the role of assumptions in Economics
Consumer Behaviour and Demand Analysis 2.1 Concept of Utility, Total and Marginal Utility, Law of Diminishing Marginal Utility. Law of Equi – marginal Utility. 2.2 Concept of demand, Types of demand, Determinants of Market demand, Law of demand. 2.3 Price elasticity of demand – Concept and Importance	1) Make a ppt presentation on U, TU, MU, Law of diminishing marginal utility and law of equi – marginal utility. 2) Conduct a GD to substantiate the point that consumer behaviour mainly depends on economic theories. 3) Conduct a case discussion on elasticity of demand. 4) A visit to a mall/ departmental store to study consumer behaviour.
Producer Behaviour and Supply Analysis. 3.1 Meaning of Supply 3.2 Market Supply 3.3 Determinants of Market Supply and Law of Supply.	1) Make a PPT differentiating total output, Stock and Supply concepts. 2) Make chart on law of supply with schedules and supply curve. 3) Prepare a project report on the Law of supply. 4) Conduct a case discussion on the elasticity of supply.
Forms of Market and Price Determination, 4.1 Perfect competition 4.2 Monopoly and Monopolistic Competition – Meaning and Features 4.3 Price Determination under Perfect Competition	1) Conduct a discussion on 'prevalence of one price is the best test of perfect competition' 2) A visit to various markets to study the competition. 3) Write a report on the features of buyers market and sellers market.
Factors of Production	1) A visit to SISI, DIC to study about entrepreneurship.

5.1 Meaning and Features of Land as a factor of production, 5.2 Labour as a factor of production, 5.3 Capital as a factor of production, 5.4 Entrepreneur, Qualities and functions of entrepreneur.	practical will consist of: <ul style="list-style-type: none"> • Preparing a project report • How to start a business • Collecting information about Permission/ Licenses required from various government agencies/ authorities • Conducting proto type market surveys using the above statistical tools • Preparing questionnaires for different types of market surveys 2) Prepare a project report on how to start an industry with financial details. 3) Conduct an interview with successful entrepreneurs. 4) Prepare a questionnaire for entrepreneurs. 5) Find out the problems faced by informal sector labour and prepare a report.
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Section II	
6.1 Meaning, Scope and Importance of Statistics in Economics	1) Analyze the charts and diagram various statistical reports. 2) Collect secondary data from journals, magazines and newspapers.
Collection and organization of data 7.1 Collection of data – primary and secondary 7.2 Methods of data collection – primary methods – Observation, Interview, Methods of secondary data – Census and sampling, Random sampling. 7.3 Organization of data – Census and sampling, Random sampling.	1) Preparation of questionnaire for personal survey method, telephone interview and mail survey. 2) Select sample respondents and conduct socio – economic survey, marketing survey, etc. 3) Choose suitable sampling method to conduct the survey. 4) Classification of collected data, tabulation of data and analysis and interpretation of data.
Graphical presentation of Data 8.1 Tables – Components and Types 8.2 Graphs – Curves, Bar diagrams, 8.3 Pie – diagrams.	1) Prepare a project report using statistical techniques, graphs, etc. 2) Prepare a bar diagram for the data collected. 3) Prepare pie charts.
Measures of Central Tendency 9.1 Mean 9.2 Median 9.3 Mode	1) Solve practical problems of mean, median, etc.

Elective - I PHYSICAL BIOLOGY (Botany & Zoology) – 1st Year
(Subject Code : 90000013)

Theory	Practical
Detailed Syllabus : 1.0. General Biology 1.1. Definition and its concept 1.2. Living World: Nature and scope of Biology 1.3. Cell and Cell division: Structure of the cell, Cell division 1.4. Main features of life and its characteristics (Irritability, Homeostasis, Adaptations, Reproduction and Growth & death. 1.5. Origin and evaluation of life 1.6. Theories of evaluation of life, origin of life, special creation, spontaneous generation, Abiogenesis, Evidences of organic evolution paleontological anatomical & embryological 1.7. Study of Tissues	Study of cells and tissues
2.0. Introduction to Botany 2.1 Origin, development and scope of Botany 1.2 Classification and its need 1.3 Nomenclature 1.4. Taxonomic Hierarchy 1.5. Five Kingdom system of classification 1.6. Two Kingdom system of classification 1.7. Thallophyta, Bryophyta and Pteridophyta 1.8. Gymnosperms, Angiosperms	Study of angiosperms and gymnosperms
3.0. Vegetative Morphology of plants 3.1. Root: Root System – types, modifications of root (storage roots, velaman roots, photosynthetic roots, respiratory roots, parasitic roots, nodular roots) 3.2 Stem: Characteristics and Functions of the stem Modifications of the stems (Aerial – Tendrils, Thorns, Hooks, Phylloclade, Tuberous stems, Bulbils: Sub Aerial – Runners, Stolons, Suckers, Offsets: Underground – Rhizome, Corm, Stem Tuber, Bulb) 3.3 Leaf: Parts and Functions (Types and Modifications of leaf base, stipule, petiole are excluded) Venation Types of leaves (simple and compound) Phyllotaxy (alternate, opposite, Whorled) Modifications of leaves (tendrils, spines, scale leaves, Phyllode, reproductive leaves, trap leaves (details of Nepenthes only)	Study of the structure of a plant (root, stem, leaf)
4.0. Reproductive Morphology of plants 4.1. Inflorescence – Types (racemose, cymose, special) 4.2. Flower – Parts, Sex Distribution, Symmetry, Position of Gynoecium, detailed description of flower (perianth, calyx, corolla, aestivation, androecium – parts, fixation, dehiscence of anther, lengths of stamens, union of stamens), gynoecium – number of carpels, fusion of carpels (excluding variations under syncarpous), ovary – number of locules, placentation, types of styles, stigma.	

SECTION B - ZOOLOGY 5.0. General Biology of Living world 5.1. Main features of life and its characteristics (Irritability, Homeostasis, Adaptations, Reproduction and Growth & death. 5.2. Origin and evaluation of life 5.3. Theories of evaluation of life, origin of life, special creation, spontaneous generation, Abiogenesis, Evidences of organic evolution paleontological anatomical & embryological 5.4. Study of Tissues	
6.0 Diversity of life 6.1 Study and Classification of animals	Classification of animals
7.0. Genetics 7.1. Chromosomal basis of inheritance	
7.0 Study of Phylum: Chordata 7.1 General characters and out line classification of Chordata up to classes with typical examples. 7.2 Fishes: Distinctive features of cartilaginous and Bony fishes with typical examples. 7.3 Amphibia: Distinctive features of Urodela, Anura and Apoda with typical examples	Study of amphibians
8.0 Study of Reptiles, Aves and Mammals 8.1 Reptiles: Distinctive characters of Squamata, Rhynchocephalia, Crocodilia and Chelonia with typical examples. 8.2 Identification of Poisonous and Non- Poisonous Snakes, Poison apparatus, toxicity of Snake venom and treatment of snake bite including the first aid. 8.3 Aves: Distinctive features of Carinatae and Ratitae with typical examples. 8.4 Mammals: Distinctive features of Prototheria , Metatheria and Eutheria.	1) Study of mammals 2) study of reptiles
9.0 Anatomy of Earthworm 9.1. General characteristics of earthworm 9.2. Digestive and reproductive system 9.3. Inter-relation of earthworm with mankind	Study of earthworm

Elective - I PHYSICAL BIOLOGY (Botany & Zoology) – 2nd Year
(Subject Code : 90000013)

Theory	Practical
Detailed Syllabus : SECTION A - BOTANY 1.0. Reproduction in Angiosperms 1.1 Introduction 1.2 Microsporogenesis and development of male gametophyte 1.3 Ovule – structure, types, megasporogenesis, development of embryo sac 1.4 Pollination – Types, Contrivances of cross and self pollination. Agents of Pollination (definition with one example only) 1.5 Fertilization: Post Fertilization changes including seed structure (dicot, Monocot) and types of germination (epigeal, hypogeal & vivipary – definitions with one example)	Detailed Syllabus Study of reproduction in angiosperms in details

1.6 Fruits: – Classification; false fruits, true fruits – simple (fleshy fruits – berry, pome, pepo, hesperidium, drupe: Dry fruits – dehiscent - legume, septicidal capsule, septifragal capsule, loculicidal capsule: Indehiscent – caryopsis, cypsela, nut: schizocarpic – lomentum, schizocarp), Aggregate and multiple fruits	
2.0. Plant Taxonomy 2.1 Introduction – alpha and omega taxonomy , aspects of taxonomy, flora, herbaria, botanical gardens (RBG – KEW , IBG – Kolkatta, NBG – Lucknow), binomial nomenclature, ICBN, Types of classification, Units of classification, brief account of Bentham and Hookers classification 2.2 Study of Malvaceae 2.3 Study of Fabaceae 2.4 Study of Solanaceae 2.5 Study of Liliaceae	
3.0. Internal Organization of plants 3.1 Tissues – Types (meristematic and permanent) and Functions 3.2 Internal Structure of Dicot Root (Primary) and Monocot root 3.3 Internal Structure of Dicot Stem (Primary) and Monocot stem 3.4 Internal Structure of leaf (Dicot and Monocot) 3.5 Secondary Growth in Dicot Stem	Study of monocot and dicot stem
4.0. Genetics 4.1 Introduction to genetics 4.2 Mendel's Principles – Monohybrid, Dihybrid cross, Concept of probability in relation to Mendel's laws 4.3 Linkage and crossing over (only concept and significance) 4.4 Mutations – gene and chromosomal (only definitions of terms: – spontaneous, induced, chromosomal structural and chromosomal numerical changes)	Mendel's principle
SECTION B - ZOOLOGY 5.0. Morphology of Humans 5.1. Nutrition and respiration in man 5.2. Locomotion in man 5.3. Study of Human Skeleton	Study of human skeleton(Bone theory)
6.0 Physiology of Humans 6.1. Circulation 6.2. Osmoregulation and excretion 6.3. Nervous co – ordination 6.4. Hormonal co – ordination	1) Study of hormones 2) study of circulation and excretion(diagrammatic chart)
7.0 Reproduction, growth and development 7.1. Details of Reproduction and human development	Study of reproduction in humans
8.0 Biology in Human welfare 8.1. Aquaculture: List of animals of aquacultural importance in Tabular form only 8.2. Poultry: Poultry farming methods, Layers and Broilers, Poultry diseases (Bacterial,Viral and Fungal - Three each) 8.3. Study of diseases: AIDS, Cancer, Typhoid 8.4. Immunity system 8.5. Biotechnology (Elementary aspects) 8.6. Applications of Biology: Vermiculture and Fishery	Study of various diseases

Subject Name : ENTREPRENEURSHIP – 1st Year

(Subject code : 90000014)

Theory	Practical
Detailed Syllabus : 1.0. Entrepreneurship 1.1. Concept, Functions and need 1.2. Entrepreneurship: Characteristics and Competency 1.3. Relevance of Entrepreneurship to Socio-Economic Gain: generating National Wealth, creating Wage and Self -Employment, Micro, Small and Medium Enterprises, Optimizing Human and Natural Resource and Solving Problems in the path of prosperity, building enterprising Personality and Society. 1.4. Process of Entrepreneurship Development.	Detailed Syllabus I. Study visit by students to any enterprise of own choice. With the help of a schedule/questionnaire the students will record observation regarding – the background of entrepreneur, reasons for selecting the entrepreneurial career, starting the enterprise, the type of enterprise, the process of setting this enterprise, products/services, production process, investment made and marketing practices followed, profit or loss, growth and development, problems faced, institutions/organizations which offer support and entrepreneur's level and type of satisfaction.
2.0. Entrepreneurial Pursuits and Human Activities: 2.1. Nature, Purpose and pattern of Human Activities: Economic and Non-Economic, Need for innovation. 2.2. Rationale and Relationship of Entrepreneurial pursuits and Human Activities.	II. Preparation of a brief report based on the observations made during study-visit to an enterprise.
3.0. Acquiring Entrepreneurial Values and Motivation 3.1 Entrepreneurial Values, Attitude and Motivation-Meaning and concept. 3.2 Developing Entrepreneurial Motivation and Competency – concept and process of Achievement Motivation, Self-efficacy, Creativity, Risk Taking, Leadership, Communication and Influencing Ability and Planning Action. 3.3. Barriers to Entrepreneurship 3.4. Help and support to Entrepreneurs	
4.0. Introduction to Market Dynamics 4.1. Understanding a Market 4.2. Competitive Analysis of the Market 4.3. Patents, Trademarks and Copyright	
5.0. Project Selection 5.1. Product Identification 5.2. Project Formulation	

ENTREPRENEURSHIP – 2nd Year

Theory	Practical
Detailed Syllabus : 1.0. Entrepreneurial Opportunities and Enterprise Creation 1.1. Sensing Entrepreneurial Opportunities 1.2. Environment Scanning 1.3. Market Assessment 1.4. Identification of Entrepreneurial Opportunities 1.5. Selection of an Enterprise 1.6. Steps in setting up of an Enterprise	Detailed Syllabus
2.0. Enterprise Planning and Resourcing 2.1. Business Planning – Preparation of a Project Report 2.2. Resource Assessment -Financial and Non – Financial. 2.3. Fixed and Working Capital Requirement, Funds, Flows, Profit Ratios, Break Even Analysis etc. 2.4. Mobilizing Resources – Sources and Means of Fund, Facilities and Technologies for starting an Enterprise.	
3.0. Enterprise Management 3.1. General management: Basic Management functions. 3.2. Organizing/Production of goods and services – quality, quantity and flow of inputs. 3.3. Managing Market: Meaning, Functions of Marketing, Marketing Mix: * Product * Price * Place * Promotion (advertising and sales promotion). 3.4. Managing Finance – Sources of Long Term and Short Term Finances, Determination of Cost, Income, Calculation of Profit/Loss. 3.5. Managing Growth and Sustenance -Affecting Change, Modernization, Expansion, Diversification and Substitution. 3.6. Entrepreneurial Discipline – Laws of Land, Ecology, Consumer's Concept, Adherence to Contract and Credits.	
4.0. Industrial Relations and Personnel Management 4.1. Meaning, Source of recruitment, Internal/External recruitment procedure 4.2. Incentives, appraisal and training, Industrial relations, Industrial disputes.	
5.0. Report Writing 5.1. Guidelines 5.2. Model project reports	

Subject Name : Psychology – 1st Year

(Subject code : 90000015)

Theory	Practical
Detailed Syllabus : 1.0. Psychology Introduction : 1.1. Definition of Psychology 1.2. Methods of Psychology 1.3. Subfields of Psychology 1.4. Schools of Psychology (a) Old (b) New	Detailed Syllabus I. Study until by student to any organization for differently able person with special needs or a centre for the treatment of the mentally ill. With the help of a questionnaire the student will record observation regarding the type of treatment given, different therapies available at the organization/centre, prognosis of the patients improvement in quality of life, support for previous care given to the patient/clients.
2.0 Memory 2.1 A Theory of General Memory Function 2.2 Information Processing Theories 2.3 The Levels of Processing Theories 2.4 The Organization of Long Term Memory 2.5 Retrieval From Long term memory. 2.6 Forgetting	II. Preparation of a brief report based on the observations made during case study-visit to an organization.
3.0 Learning 3.1 Definition 3.2 Classical Conditioning 3.3 Instrumental Conditioning 3.4 Escape Learning 3.5 Avoidance Learning 3.6 Signature of Instrumental Conditioning 3.7 Cognitive Learning	
4.0 Motivation 4.1 Definition 4.2 Motives as References, Explanations and Predictions. 4.3 Theories of Motivation 4.4 A Normal of Biological Motivation 4.5 Biological Motivation 4.6 Social Motives 4.7 Self-Actualization Motivation 4.8 Frustration and Conflict of motives	
5.0 Personality 5.1 Definition 5.2 Theories of Personality	
6.0 Motivation 6.1 Definition 6.2 Etiology 6.3 Diagnosis 6.4 Clinical Features 6.5 Treatment	
7.0 Perception and Attention 7.1 Definition of Perception 7.2 Sensory Processes 7.3 Illusions 7.4 Attention	

8.0 Emotions 8.1 Definition 8.2 Expression and Perception of Emotions 8.3 Physiology of Emotions 8.4 Stress	
9.0 Intelligence 9.1 Definition 9.2 Intelligence Quotient (IQ) 9.3 Intelligence Testing	

Abnormal Psychology - 2nd Year

Theory	Practical
Detailed Syllabus : 1.0. Abnormal Psychology 1.1. Definition of Psychological Disorder 1.2. Classification of Psychological Disorder	Detailed Syllabus <p>The Main objective of the course in Psychology is to help the students establish a better rapport with their clients. A basic understanding and knowledge of this subject will enable the students to deal with each client as an individual, while also being aware of his/her unique needs. Also, due to the established mind-body connection, some patients requiring Physiotherapy have a Psychological cause as the basis of their physiological symptoms. Severe physiological symptoms requiring therapy can lead to psychological conditions in the patient. Relevant knowledge of psychology can help sensitize the physiotherapist to the needs of the client and treat the patient in a more holistic manner.</p> <p>Such a course would need to have an experimental component in the form of practical work. The objectives of the practical work are :-</p> <ol style="list-style-type: none"> 1. To give the students firsthand experience in field work with hospitals / centers catering to the psycho-physiological needs of patients. 2. To develop in the students the skill and sensitivity to deal with each patient as an individual with his or her own unique need. 3. To guide the students to prepare a project report. 4. To equip the students to make a note of patients psychological conditions in the case history of the patient. 5. To instill in the students the right values and a greater understanding of their patients.

2.0 Schizophrenia 2.1 Definition 2.2 Symptoms 2.3 Subtypes 2.4 Treatment 2.5 Prognosis	
3.0 Paranoia 3.1 Definition 3.2 Symptoms 3.3 Subtypes 3.4 Treatment	
4.0 Manic Depressive Psychosis 3.1 Definition 3.2 Symptoms 3.3 Subtypes	
5.0 Melancholia 5.1 Symptoms 5.2 Treatment	
6.0 Anxiety 6.1 Symptoms of anxiety 6.2 Difference between normal fears and anxiety disorder 6.3 Peripheral manifestations of pathological anxiety. 6.4 Classification of anxiety disorder. 6.5 Treatment	
7.0 Phobia 7.1 Definition 7.2 Symptoms 7.3 Types of phobia 7.4 Treatment	
8.0 Obsessive Compulsive neurosis (OCN) 8.1 Definition of Obsession 8.2 Definition of Compulsion 8.3 Symptoms 8.4 Treatment	
9.0 Hysterical Conversion Disorder 9.1 Definition 9.2 Clinical features (Symptoms) 9.3 Treatment	
10.0 Neurasthenia 10.1 Definition 10.2 Symptoms 10.3 Treatment	
11.0 Personality Disorders 11.1 Definition 11.2 Symptoms 11.3 Classification / Types of Personality Disorders 11.4 Anti-social Personality Disorder (i) Etiology (ii) Treatment	
12.0 Psychotherapy 12.1 Definition 12.2 Types of Psychotherapy	

13.0 Organic Psychosis 13.1 Definition 13.2 Symptoms 13.3 Types of Organic Psychosis (i) Causes (ii) Clinical Features (iii) Treatment (iv) Course and Prognosis	
14.0 Alcohol Related Mental Disorders 14.1 Definition 14.2 Etiology 14.3 Classification 14.4 Treatment and Rehabilitation.	
15.0 Epilepsy 15.1 Definition 15.2 Varieties / Types of epilepsy 15.3 Cause of epilepsy 15.4 Aggravating factors 15.5 Post-ictal disorders 15.6 Epilepsy Vs. Pseudo-seizures 15.7 Status Epilepticus & treatment 15.8 Treatment of Epilepsy	
16.0 Mental Retardation (MR) 16.1 Definition 16.2 Classification 16.3 Etiology 16.4 Diagnosis 16.5 Clinical Features 16.6 Treatment	
17.0 Frustration and conflict 17.1 Definition of Frustration 17.2 Sources of Frustration 17.3 Types of conflict	
18.0 Mental Mechanisms 18.1 Classification	

PRACTICAL (Second Year)

Introduction:

The Main objective of the course in Entrepreneurship is to generate in the students initiative, self reliance and enthusiasm so as to empower them to become entrepreneurs both in spirit and performance. A number of skills such as observation, evaluation, communication, resource mobilization and management, risk assessment, team building etc. is also to be developed in the students. Leadership qualities, sensitivity to business ethics and adherence to a positive value system are the core issues that the course highlights while presenting different concepts related to entrepreneurship.

Such a course should necessarily have a strong experiential component in the form of practical work. The objectives of the practical work are:

- 1 To introduce the students to the world of business by developing in them the core skills and competencies required for an entrepreneur.
2. To develop in the students qualities such as leadership, self-confidence, initiative, facing uncertainties, commitment, creativity, people and team building, integrity and reliability.

3. To enable the students to acquire the skills and knowledge needed for conducting surveys, collecting, recording and interpreting data and preparing simple estimates of demand for products and services.
4. To guide the students to prepare a Project Report.
5. To equip the students with knowledge and skills needed to plan and manage an enterprise through case studies conducted and recorded by the students in different fields such as resource assessment, market dynamics, finance management, cost determination, calculation of profit and loss etc.
6. To instill in the students important values and entrepreneurial discipline.

FORMAT

Total marks: 30

1. Project Report/Survey Report	10 Marks
2. Viva-Voce on PW /SR	05 Marks
3. Case Study	10 Marks
4. Problem Solving	05 Marks

1. Project Report/Market Survey Report

10 Marks

a) Project Report:

Preparation of a Project Report for an enterprise involving products/services Students may be provided adequate guidance to choose a project based on their interests and availability of information and authentic inputs in the locality. The specimen proforma of project report given in the textbook may be used for preparing the report. However, mechanical preparation of the report by filling in the information in the proforma should be discouraged.

Further, as the students will be required to appear for a Viva-voce on the basis of their projects, sufficient care should be taken by the students to prepare the report after studying the various aspects involved thoroughly. In a nutshell, the project report should lead to viable enterprise.

b) Market Survey Report

Market research is the process and technique of finding out who your potential customers are and what they want. The survey may be on products and services already available in the market or students may also conduct surveys for new products and services. The report of the survey should be organised under the following broad headings :

1. Objectives.
2. Methods and tools (interviews ,questionnaires etc.) to be used to collect information.
3. Records of data and information.
4. Analysis of data and information.
5. Interpretation and conclusion.

For example, a survey may be conducted to find out the choice of households in toiletry soap, tooth paste etc. The data may be analysed to establish a pattern that may be useful to an entrepreneur.

Guidelines for assessment of Project Report / Survey Report

1. Presentation: Format, Clarity, Use of graphs, tables and other visuals, organisation, methodical recording of data and information and general neatness of execution. 5 marks
2. Originality and Creativity 3 marks
3. Authenticity of information and correctness of calculations and general feasibility of the project/ sustainability of conclusion drawn in the survey. 2 marks

2. Viva Voce on the Project /Market Survey Report

5 Marks

The questions should establish that the report is the original work of the student and that the student has a reasonably clear understanding of the work carried out by him/her. Entrepreneurial qualities such as leadership, self-belief, creativity, originality, initiative etc. may also be assessed by asking a variety of questions related to the report.

3. Case Study

10 marks

A case study is a focused research on an organisation, enterprise, practice, behaviour or person undertaken to highlight an aspect that the study attempts to examine. For instance, a case study may be conducted on the pollution control methods being employed by an industry. Or a successful industrialist may be chosen as a subject of a case study to analyze and understand the strategies that the industrialist adopted :to achieve success.

Ideally, a case study should be conducted on subjects with the objectives of bringing to the fore beliefs, practices, strategies, values etc. that have made them what they are. Such studies help us to understand the way in which great minds think and operate. We may also conduct case studies on failures; why a company collapsed, how a service lost its market etc. From both the types of case study, we learn lessons; how to do something or how not to do something. They also provide valuable insight into the processes involved in an enterprise.

A few topics are suggested for carrying out case studies :

- i) Drawing a profile of a successful entrepreneur.
- ii) Studying a public sector undertaking and highlighting its success/failure, by analyzing the factors responsible.
- iii) Studying a small scale unit in the locality to bring out the procedures and processes adopted by the unit to become a feasible business venture.
- iv) A study of competition in business by choosing two or more rivals in the market and analyzing their strengths and weaknesses.
- v) Take the school itself for a case study and analyze any two aspects of the school plant for chalking out a plan of action: infrastructure, academics, co-curricular activities etc.
- vi) A case study on a thriving fast food shop/restaurant in your locality. What makes it so popular?
- vii) A case study on the ways in which a business unit has mobilised its financial resources.
- viii) A case study on the enterprise management techniques adopted by a business house.
- ix) A case study on the marketing strategies of a successful consumer durable company.
- x) A case study on the financial management of a Public Limited Company.
- xi) A case study on any Specialized Institution that supports and guides the establishment of a small scale unit.
- xii) Studying the balance sheets of two big private companies to assess their trade and credit worthiness.
- xiii) Studying the inventory management of a large manufacturing industry to ascertain the processes involved for optimizing cost.
- xiv) Carrying out a case study on an established industrial house/company to find out the value system of the company and how it fulfils its social commitment/obligations.
- xv) Carrying out a case study on an established industry to ascertain the processes followed to reduce/prevent pollution.
- xvi) Study on environment friendly companies and their contribution to preservation.

Assessment of Case Studies

- | | |
|---|---------|
| i) Presentation: Format, accuracy, clarity, authenticity and general neatness | 7 marks |
| ii) Analysis and Conclusions | 3 marks |

4. Problem Solving

5 marks

In this session, the students will be required to solve a problem in the form of a written test. The examiner may choose any problem related to the units in class XII Text Book and set it for the class. The problem may be in the following areas :

- a. How to scan the environment to establish the feasibility of a project.
- b. Given certain figures showing the consumption pattern of a product, drawing conclusions that have a bearing on similar products.
- c. Carrying out market assessment for a given product/service to ascertain the feasibility factor.
- d. Assessment of Working Capital.
- e. Calculation of total cost of production.
- f. Calculation of break-even point.
- g. Determining location of a manufacturing unit.
- h. Problems in inventory control (calculation of the Economic Order Quantity and carrying out ABC analysis).
- i. Applying Pricing methods to determine the price of a product or service.
- j. Applying promotion mix to plan a sales campaign for a product or service.
- k. Working out a simple budget for a given task or job.

Assessment of Answers

The examiner may prepare five problems which are solved by him/her before they are presented to the students. The student may choose anyone of the problems and solve it, showing the different steps/different reasons involved in the solution. If the problem does not involve actual calculations, it may not have anyone correct answer. So weightage should be given not only to the final answer but to the entire process of problem solving that the student has followed.

Originality and innovative spirit should be rewarded. The students should not be penalized for pelling errors, grammatical mistakes etc. as long as the answer is coherent. Where definite formulas are involved, accuracy should be given due weightage.

LIST OF SUGGESTED REFERENCE BOOKS

01. Entrepreneurship – Class XI – C. B. S. E., Delhi.
02. Entrepreneurship – Class XII- C. B. S. E., Delhi.
03. Udyamita (in Hindi) by Dr. M M.P. Akhouri and S.P Mishra, pub. by National Institute for Entrepreneurship and Small Business Development (NIESBUD), NSIC-PATC Campus, Okhla.
04. Trainer’s Manual on Developing Entrepreneurial Motivation, By M.M.P. Aukhori, S.P. Mishra and R. Sengupta, Pub. by (NIESBUD), NSIC-PATC Campus, Okhla.
05. Behavioral Exercises and games – manual for trainers, learning systems, by M. V. Despande, P. Mehta and M. Nandami.
06. Product Selection by Prof. H.N. Pathak, Pub. By (NIESBUD), NSIC-PATC Campus, Okhla.
07. Entrepreneurial Development – Dr. S. Moharana and Dr. C.R.Dash, Pub. by RBSA Publishers, Jaipur.
08. Entrepreneurial Development by S.S.Khanna, Published by S.Chand & Company Ltd., Ram Nagar, New Delhi.
09. Entrepreneurial Development by C.B. Gupta and N.P.Srinivasan, Publisher Sultan Chand & Sons, 1992.
10. Entrepreneurship Development – Principles, Policies and Programmes by P. Saravanel, Publishers Ess Pee Kay Publishing House, Madras.
11. Entrepreneurship, Growth and Development, by Rashi Ali, Pub. by Chugh Publication and Strech Road, Civil Lines, Post Box No. 101, Allahabad-211991.
12. Entrepreneur and Entrepreneurship Development and Planning in India, by D.N.Mishra, pub. by Chugh Publication, Allahabad.
13. Aoudhogik Disha Nirdesh (in Hindi) Pub. by Centre for Entrepreneurship Development, M.P. (CEDMAP), 60, Jail Road, Jhangerbad, Bhopal-462008.
14. Entrepreneur, Industry and Self-employment Project, Part-I and 2(in Hindi), Pub. by Centre for Entrepreneurship Development, M.P. (CEDMAP), 60 Jail Road, Jhangerbad, Bhopal-462008.
15. Small Scale Industry & Self-Employment Projects, Part-I and 2 (in Hindi), Pub. by Centre for Entrepreneurship Development, M.P. (CEDMAP),60 Jail Road, Jhangerbad Bhopal.

Magazines

01. Udyamita Samachar Patra,(Monthly, Hind), Pub. by Centre for Entrepreneurship Development, M.P.(CEDMAP), 60 Jail Road, Jhangerbad, Bhopal-462008.
02. Science Tec. Entrepreneur (A Bi Monthly Publication), centre for Enterprenurship Development, M.P. (CEDMAP), 60 Jail Road, Jhangerbad , Bhopal -462008.
03. Laghu Udhdyog Samachar.
04. Project Profile by DCSSI.
05. Project Profile by Pub. Centre for Enterpreurship Development, M.P. (CEDMAP), 60 Jail . Road, Jhangerbad, Bhopal-462008.

Elective – II - APPLIED SCIENCE (Physics & Chemistry) – 1st Year

(Subject Code – 90000021)

Theory	Practical
Detailed Syllabus : SECTION A : PHYSICS 1.0. Measurement, Units, and Dimension 1.1 Introduction: Need for measurement, Units and documents, accuracy, precision of measuring instruments. 1.2 Types of Errors: Constant error, systematic error, environment error (errors due to external causes). Error due to imperfection, random error, gross error, percentage error. 1.3 Combination of Error: Error due to addition, subtraction, multiplication, division, powers of observed quantities. 1.4 Units and Dimensions: Fundamental and derived physical quantities, systems of units in SI systems. Rules for writing units in SI, derived units in SI. Multiples and submultiples of SI units. 1.5 Dimensions: dimensional formulae and dimensional equations, dimensional constants and dimensionless quantities, principle of homogeneity of dimensions. 1.6 Application of dimensional method of analysis: Conversion of one system of units into another, to check the correctness of an equation, to derive the relationship between different physical quantities. 1.7 Order of magnitude and significant figures 1.8 Concept of accuracy and estimation of errors	Detailed Syllabus Perform a simple experiment on measurement and error
2.0. Scalars and Vectors 2.1. Introduction to scalars and vectors 2.2. Addition and subtraction of vectors 2.3. Product of vectors	
3.0. Motion & Force 3.1. Definition of Motion, Uniformly accelerated motion along straight line 3.2. Position time graph and velocity-time graph 3.3. Equation of a projectile path 3.4. Time of light, Horizontal range, Maximum height of a projectile 3.5. Definition and types of forces 3.6. Introduction to gravitation, electromagnetic and nuclear forces 3.7. Law of conservation of momentum 3.8. Elastic and inelastic collisions 3.9. Momentum of force, couple and properties of couple 3.10. Centre of mass and gravity 3.11. Conditions of equilibrium of a rigid body	Experiment on gravitational force (example of a ball falling from a certain height)

4.0. Friction 4.1. Origin and nature of frictional forces 4.2. Laws of static and kinetic frictions 4.3. Pressure due to fluid column 4.4. Pascal's law and its applications 4.5. Newton's formula 4.6. Stoke's law 4.7. Equation for terminal velocity 4.8. Bernaulli's principle and its applications	Proof of Stoke's theorem and Bernaulli's principle
5.0. Dynamics 3.1 Introduction, Newton's Law of Motion. 3.2 Application of Newton's laws – Objects suspended by strings, blocks placed in contact with each other on frictionless horizontal surface, apparent weight in a lift. 3.3 Impulse, Law of conservation of linear momentum, Conservation of linear momentum during collision. 3.4 Work, power, energy potential Energy (PE), Kinetic Energy (KE), definition & derivation for both, relation between KE & linear momentum. 3.5 Conservation and non conservative forces, Work energy theorem, law of conservation of energy in case of freely falling body and vertically projected body.	Derivation for Potential energy and kinetic energy
6.0. Sound waves 6.1. Waves and oscillations 6.2. Progressive waves 6.3. Characteristics of transverse waves, longitudinal waves 6.4. Sound as longitudinal wave motion 6.5. Definition of period, frequency, wavelength giving their relations. 6.6. Newton's formula for velocity of sound, laplace's correction	
7.0. Thermal expansion 7.1. Expansion of solids, liquid 7.2. Linear expansion, area and volume expansion 7.3. Thermal conduction, temperature gradient and coefficient of thermal conductivity	Experiment on expansion of solids in a thermal envirnment
8.0. Refraction of light and lens 8.1. Refraction of light: Refraction of monochromatic light, Snell's law, Total internal reflection, Critical angle, Optical fiber, Dispersion of light, Prism formula, Rainbow, Scattering of light 8.2. Wave Theory of light: Huygen's principle, Construction of plane and spherical wave front, Wave front and wave normal, Reflection at a plane surface, Polarization, Plane polarized light 8.3. Interference and Diffraction: Interference of light, Condition's for producing steady interference, Young's experiment, analytical treatment, expression for path difference and fringe width, Measurement of wavelength by bi prism experiment, Diffraction due to single slit, Rayleigh's criteria, Difference between interference and diffraction 8.4. Critical angle, Optical fiber, dispersion of light, Prism formula, angular dispersion and dispersive power	Experiment on Refraction of light using a prism

8.5. Refraction at single curved surface 8.6. Lens maker's equation 8.7. Concept of conjugate foci 8.8. Magnifying power of simple microscope, compound microscope and telescope 8.9. Lens defects	
9.0. Modern Physics <u>Part A – Electrons and Photons</u> 9.1. Discovery of electron 9.2. Charge and mass of electron 9.3. Photo electric current 9.4. Einstein's equation 9.5. Photoelectric cell and its applications <u>Part B – Atoms, Molecules and Nuclei</u> 9.6. Bohr's model 9.7. Hydrogen spectrum 9.8. Laser as a light source 9.9. Wavelength of an electron 9.10. Davisson and Germer experiment 9.11. Elementary idea of electron microscope	

SECTION B – CHEMISTRY 1.0. Basics of Chemistry 1.1. Importance of Chemistry 1.2. Fundamental and derived units and their SI units 1.3. Gay-Lussac's law, Avogadro's law 1.4. Derivation of molecular weight, gram molecular volume 1.5. Stoichiometry Mole concept 1.6. Equivalent weight, Atomic weight, Molecular weight 1.7. Percentage composition and molecular formula 1.8. Numerical based on weight-volume relationship	Solve Problems based on weight – volume relationship
2.0. Atomic Structure 2.1 Characteristics of electron, proton and neutron. 2.2 Rutherford model of an atom. 2.3 Nature of electromagnetic radiation, 2.4 Planck's quantum theory. 2.5 Explanation of photo electric effect. 2.6 Features of atomic spectra. 2.7 Characteristics of hydrogen spectrum. 2.8 Bohr's theory of the structure of the atom. 2.9 Bohr's explanation of spectral lines. 2.10 Failure of Bohr's theory. 2.11 Wave-particle nature of electron. 2.12 de Broglie's hypothesis, Heisenberg's uncertainty principle. 2.13 Important features of the quantum mechanical model of an atom. 2.14 Quantum numbers, concept of orbitals, define an atomic orbital in terms of quantum numbers – shapes of s, p and d orbitals, state Aufbau principle, Pauli's exclusion principle and Hund's rule of maximum multiplicity. 2.15 Electronic configurations of atoms. Explanation of stability of half filled and completely filled orbitals.	Study of Planck's quantum theory and Bohr's theory

3.0 Classification Of Element And Periodicity In Properties 3.1 The concept of grouping elements In accordance to their properties. 3.2 The periodic law. 3.3 The significance of atomic number and electronic configuration as the basis for periodic classification. 3.4 Classify elements into s, p, d, f blocks and discuss their main characteristics. 3.5 Periodic trends in physical and chemical properties of elements. 3.6 Periodic trends of elements with respect to atomic radii, ionic radii, inert gas radii, ionization energy, electron gain energy, electro negativity and valence. 3.7 Variation of atomic radii in inner transition elements.	Study of Structure of periodic table
4.0. Redox Reaction 4.1. Introduction to Oxidation & Reduction 4.2. Electron transfer concept 4.3. Oxidising & Reducing agents 4.4. Redox reactions in aqueous solutions 4.5. Oxidation number and rules for assigning oxidation number 4.6. Balancing of chemical equations	
5.0. Chemical Equilibrium 5.1. Introduction: Reversible and irreversible reactions 5.2. Rate of reaction and factors affecting it 5.3. Chemical Equilibrium 5.4. Laws of Mass action, Equilibrium constant, relationship between K_p and K_c	Numerical problems based on K_p and K_c
6.0. Adsorption: 6.1. Concept of adsorption 6.2. Difference between absorption and adsorption 6.3. Physical and chemical adsorption 6.4. Factors affecting adsorption 6.5. Applications of adsorption	Experiment on absorption(example of a sponge) to give the difference between absorption and adsorption
7.0 Chemical Bonding and Molecular Structure 7.1 Kossel-Lewis approach to chemical bonding. 7.2 Factors favorable for the formation of ionic bond, energy changes in ionic bond formation. 7.3 Crystal lattice energy – calculation of lattice energy – Bom-Haber cycle. 7.4 Crystal structures of sodium chloride and Caesium chloride. 7.5 Properties of ionic compounds. 7.6 Covalent bond – VSEPR theory and predict the geometry of simple molecules. 7.7 The valance bond approach for the formation of covalent bonds. 7.8 Directional properties of covalent bond. 7.9 Properties of covalent bond. 7.10 Different types of hybridization involving s, p and d orbitals and draw shapes of simple covalent molecules. 7.11 Definition of coordinate covalent bond with examples. 7.12 Description of molecular orbital theory of homonuclear diatomic molecules. 7.13 Bonding, antibonding molecular orbitals, o, n bond orbitals, their symmetry. 7.14 Energy diagrams of molecular orbitals of H ₂ , N ₂ and O ₂ .	

7.15 Concept of hydrogen bond – Types of hydrogen bonds, inter and intra molecular hydrogen bonds. 7.16 Effect of hydrogen bonds on some properties of substances with examples. 7.17 Different states of matter in terms of balance between intermolecular forces, thermal energy of particles.	
8.0. S-block, P-block, d-block & F-block elements 8.1. Introduction to S & P blocks 8.2. Position in periodic table, general electronic configuration 8.3. Comparison between alkali and alkaline earth metals 8.4. Sodium occurrence, uses of sodium 8.5. Methods of extraction 8.6. Physical and chemical properties 8.7. Difficulties in isolation of fluorine 8.8. Methods of preparation 8.9. Uses of fluorine	

Elective – II - APPLIED SCIENCE (Physics & Chemistry) – 2nd Year

(Subject Code – 90000021)

Theory	Practical
Detailed Syllabus : SECTION A - PHYSICS 1.0. Electrostatics 1.1 Gauss's theorem, proof and application 1.2 Mechanical force on unit area of a charged capacitor 1.3 Energy density of a medium 1.4 Concept of a condenser 1.5 Capacity of parallel plate condenser 1.6 Effect of dielectric on capacity 1.7 Energy of a charged condenser 1.8 Condensers in series and parallel	Detailed Syllabus 1) Proof of Gauss's theorem 2) Solve numericals on series and parallel plate capacitors
2.0. Current, Electricity and Magnetic effects of electric current <u>Part A – Current Electricity</u> 2.1. Ohm's Law 2.2. Ohmic and non-ohmic resistances , specific resistance, conductance, 2.3. Temperature dependence of resistivity 2.4. Thermistor 2.5. emf of a cell - internal resistance and back e.m.f's 2.6. Kirchoff's laws: statement and explanation, application to wheatstone's bridge for its balance conditions , metre bridge, principle of potentiometer 2.7. Comparison of e.m.f. of cell, determination of internal resistance of a primary cell, Series and parallel combination of cells.	1) Solve numericals on Ohm's law 2) Experiment on wheatstone's bridge

<p><u>Part B – Magnetic effects of electric current</u></p> <p>2.8. Biot Savart's law</p> <p>2.9. Right hand Thumb rule</p> <p>2.10. Magnetic induction at the center and at the point along the axis of circular coil carrying current</p> <p>2.11. Flemming's left hand rule</p> <p>2.12. Definition of Ampere</p> <p>2.13. Ampere's law and its applications</p> <p>2.14. Moving coil galvanometer</p> <p>2.15. Ammeter</p> <p>2.16. Voltmeter</p>	
<p>3.0. Magnetism</p> <p>3.1. Coulomb's inverse square law</p> <p>3.2. Couple acting on a bar magnet placed in a uniform magnetic field</p> <p>3.3. Magnetic moment of a magnet</p> <p>3.4. Expression for Magnetic induction due to a bar magnet on axial and Equatorial lines</p> <p>3.5. Superposition of magnetic fields</p> <p>3.6. Tangent law</p> <p>3.7. Deflection Magnetometer</p> <p>3.8. Comparison of magnetic moments in Tan-A and Tan-B positions by Equal distance method and null method</p>	
<p>4.0. Electromagnetic waves</p> <p>4.1. Electromagnetic waves and their characteristics</p> <p>4.2. Transverse nature of electromagnetic waves</p> <p>4.3. Electromagnetic spectrum</p> <p>4.4. Propagation of electromagnetic waves in atmosphere</p>	
<p>5.0. Electromagnetic Induction</p> <p>5.1. Laws of electromagnetic induction</p> <p>5.2. Eddy currents</p> <p>5.3. Self and mutual induction</p> <p>5.4. Transformer</p> <p>5.5. Coil rotating in uniform magnetic field</p> <p>5.6. Alternating currents</p> <p>5.7. Reactance and impedance</p> <p>5.8. Power in a a.c. circuit with resistance, inductance and capacitance</p> <p>5.9. Resonant circuit</p>	<p>Solve numericals on power in a.c circuit, transformers and resonating circuits</p>
<p>6.0. Semiconductors</p> <p>6.1. Energy bands in solids</p> <p>6.2. Intrinsic and extrinsic semiconductors</p> <p>6.3. p – type and n – type semiconductors</p> <p>6.4. P – N junction diode</p> <p>6.5. LED</p> <p>6.6. Rectifiers</p> <p>6.7. Zener diode as a voltage regulator</p> <p>6.8. Solar cell</p> <p>6.9. Transistor as an amplifier</p> <p>6.10. Oscillators</p> <p>6.11. Logic gates</p>	

7.0 Communication 7.1. Space communication 7.2. Ground, sky and space wave propagation 7.3. Satellite communication 7.4. Line communication 7.5. Two wire lines 7.6. Cables 7.7. Optical communication	Study of various types of cables and wires
SECTION B - CHEMISTRY 6.0. Electrochemistry 6.1 Electrolytes and Non-electrolytes. 6.2 Faraday's laws of electrolysis. 6.3 Galvanic & Voltaic cells representation 6.4 Nernst equation (No derivation) , e.m.f. calculations.	Experiment on faraday's law of electrostatics
7.0 Nuclear Chemistry 7.1 Composition of Nucleus - Isotopes, Isotones, Isobars, Nuclear stability - Factors effecting Nuclear stability, mass defect, binding energy, Average binding energy, N/P ratio, Magic Numbers). 7.2 Radio-active disintegration and its rate-Half-life and average life. 7.3 Natural and artificial radio-activity, disintegration series-Group displacement law-Types of Nuclear reactions (fission and fusion)-Differences between Nuclear and Chemical reactions- Radio-active isotopes and their applications Iodine 131 , Cobalt 60 , Sodium 24 , C 14 and P 30.	Solve numericals on binding energy and half life rate
8.0 Surface Chemistry 8.1 Adsorption and absorption. Physical and chemical adsorption-distinguishing properties- Adsorption of gases on Metals Adsorption from solutions (Elementary treatment). 8.2 Colloidal state:- True and colloidal solutions – Explanation of the terms - Dispersion medium, dispersed phase, lyo-philic and lyo-phobic sols using the examples; smoke, cloud, blood, milk, starch solution and gold sol. 8.3 Emulsions:- Emulsifying agent and emulsification - its applications. Cleansing action of soap. 8.4 Catalysis - Explanation of the terms – Homogeneous and Heterogeneous catalysis – distinctions with suitable Examples-auto catalysis with one example	
9.0. Acids and Bases 9.1 Theories of Acids and Bases Lowry - Bronsted concept Lewis theory of acids and bases. 9.2 Ionic product of water, PH, Buffers - Numerical problems on these, Indicators - Choice of indicators, PH-range and uses. 9.3 Salt hydrolysis - Types of hydrolysis with examples.	Solve numericals on pH value.

10.0 Alkanes, Alkenes, Alkynes and Aromatic compounds 10.1. Introduction and importance of organic chemistry 10.2. General characteristics of organic compounds Classification of organic compounds	
11. Ethers 11.1 Introduction:- Definition 11.2 Classification:- 11.3 Nomenclature and metamerism 11.4 Preparation, Reactions & Uses	Study of Simple and mixed ethers with examples.
12. Aldehydes and Ketones 12.1 Introduction 12.2 Carbonyl Compounds & classification 12.3 Nomenclature of aldehydes and ketones 12.4 Preparation & reaction of Aldehydes and ketones	
13.0 Acids & Esters 13.1. Introduction, Nomenclature, preparation, Reaction and uses of Acids & Esters	Study of various types of acids
14.0. Amines 14.1. Introduction, Classification and Nomenclature 14.2. Preparation of primary amines 14.3. Reaction of amines	
15.0. Biomolecules & Synthetic Fibres 15.1. Introduction 15.2. Carbohydrates and Proteins 15.3. Fats & Oils 15.4. Classification of Fibres 15.5. Preparation of fibres 15.6. Physical properties and uses of fibres	Study of fibres
16.0. Chemistry in application 16.1. Application of Chemicals in Medicine & healthcare 16.2. Application of chemicals in Food preservatives 16.3. Application of chemicals in Agricultural products	

Elective –II - Computer Applications– 1st year
(Subject Code – 90000022)

Theory	Practical
Detailed Syllabus : 1.0. Introduction 1.1. Basic Computer and its structural theory 1.2. Input devices 1.3. Output devices 1.4. Storage devices 1.5. Computer types and their applications 1.6. Computer Software/Hardware	Detailed Syllabus 1.0. Computer basics 1.1. Identification of Keyboard, Printer, Monitor Scanner, Webcam, Microphone, Speaker 1.2. Sample collection of various type of storage devices, specifications and charts
2.0. Operating systems 2.1. Various types of Operating systems 2.2. Comparison between the different types of OS 2.3. Network Operating systems and their features 2.4. Microsoft Disk Operating System, its nature and history. 2.5. Unix, features, merits and demerits in using Unix as OS. 2.6. Microsoft Windows, development & growth of MS Windows, features, merits and demerits of MS Windows. 2.7. MS Windows NT, features, merits & demerits 2.8. System requirements for various Operating Systems 2.9. Windows default icons and their applications	2.0. Practice 2.1. Practice of MS DOS commands 2.2. Installation of MS Windows 2.3. Practice on Add/Remove programs 2.4. Practice on My computer, Display properties, My documents, My Network places
3.0. Microsoft Word 3.1. Introduction to MS Office 3.2. MS Word applications 3.3. Creation of Document and file operations 3.4. Formatting features of document 3.5. Modification/ editing documents 3.6. Inserting images, files, tables, symbols and various attributes 3.7. Creating and formatting of tables 3.8. Mail merge 3.9. Page layout and design features 3.10. Spell & grammar check in documents 3.10. Print preview & printing of documents 3.11. Converting documents to PDF files.	3.0. Documentation 3.1. Create and save a document 3.2. Format the text with different font size, font styles 3.3. Setting up different page sizes, orientation. 3.4. Making various type of documents like Bio Data, letters, project reports 3.5. Printing of documents
4.0. Microsoft Excel 4.1. Introduction to Excel and its applications 4.2. Features of MS Excel 4.3. Outline of Worksheet & Workbook 4.4. Data types 4.5. Study of various menus of MS Excel 4.6. Creation of worksheet, editing worksheets, save, copy & deleting worksheets. 4.7. Functions of MS Excel 4.8. Formulas of MS Excel. 4.9. Types of charts, creation of data Charts, editing and insertion of charts. 4.10. Sort facility 4.11. Interconnecting Charts 4.12. Page setup, printing worksheets, charts... etc. 4.13. Converting Worksheets to PDF files.	4.0. Practice of Worksheets 4.1. Create and save worksheets 4.2. Editing the worksheets 4.3. Formatting worksheets 4.4. Insert charts 4.5. Making worksheets using formulas & functions 4.6. Making worksheets & printing with different formatting effects 4.7. Making worksheets with images, numbers and print them

Theory	Practical
5.0. MS Power point 5.1. General Introduction 5.2. Features & Applications of MS Power point 5.3. Creating Presentations 5.4. Study of different layouts and making presentations using different layouts 5.5. Using different animation effects. 5.6. Add Audio/Voice and visual effects to slides. 5.5. Filtration 5.6. Converting presentations to PDF files. 5.7. Inserting images, symbols to slides	5.0. Power Point practice 5.1. Create Slides of different types 5.2. Running presentations 5.3. Add slide transition effects and run slide show 5.4. Make presentations with audio/visual effects. 5.5. Printing PPT files 5.6. Making PDF format of PPT files
6.0. Networking & Internet Utilities 6.1. General Introduction of Computer Networking 6.2. Requirements/ Applications of Computer Networking 6.3. Layouts of Different Networks 6.4. Study of various Networking components 6.5. Limitations and merits of different topologies 6.6. Study of Server/client concept 6.7. Internet & its applications 6.8. Email and Chatting 6.9. E-trading concepts 6.10. Downloading files (Text and media files)	6.0. Networking practice 6.1. Identifying different network components 6.2. Collecting samples, charts, images of different networking components. 6.3. Installation of Network Interface card 6.4. Getting connected to Internet and accessing the internet 6.5. Creating personalized Email account 6.6. Chatting (Text and Voice chat) 6.7. Searching/surfing for the information in different sites. 6.8. Downloading
7.0. Project work 7.1. Understand the concept of making projects and preparing the project reports. 7.2. Preparation of a project using the software skills learned during the course.	7.0. Project Work 7.1. Making a working model/project using MS Excel/Power Point 7.2. Project Report

Elective –II - Computer Applications– 2nd year

(Subject Code – 90000022)

Theory	Practical
Detailed Syllabus : 1.0. Introduction MS Access 1.1. Objects of learning MS Access 1.2. Applications of MS Access 1.3. Database and Database Management System 1.4. Elements of Database Management System 1.5. Types of Data Bases & the merits & demerits	1.0. Study of overview of MS Access 1.1. Accessing MS Access and its menus to get familiar with it
2.0. Controlling Data Entry 2.1. Restrict Data Entry using field properties 2.2. Establish a pattern for entering field values 2.3. Create a list of values for a field	2.0. Creating Data Tables, Designing Fields and setting field properties
3.0. Joining Tables and creating Queries 3.1. Create Query joins 3.2. Join unrelated tables 3.3. Relate data within a table 3.4. Set Select Query properties 3.5. Create Parameter Queries 3.6. Create Action Queries	3.0. Creating Queries

4.0. Forms & Reports 4.1. Design a Form Layout 4.2. Enhance the appearance of a Form 4.3. Restrict Data entry in forms 4.4. Adding a command button to a Form 4.5. Create a Subform 4.6. Organize report information 4.7. Format the report 4.8. Set Report Control properties 4.9. Control Report pagination 4.10. Summarize Report information 4.11. Add a sub report to an existing report 4.12. Create a mailing label report	4.0. Practicing Forms and Reports 4.1. Creating different forms using different layouts 4.2. Data entry in to the forms 4.3. Creating different Reports using different layouts 4.4. Data formatting in to reports
5.0. Sharing data across applications 5.1. Import data in to Access 5.2. Export data from Access 5.3. Analyze Access data in Excel 5.4. Export Access data to a Text file 5.5. Merge Access data with a Word document	5.0. Practice: 5.1. Import Excel sheets in to Access 5.2. Import Tables in to Access 5.3. Export Access tables in to Excel format 5.4 Export Access data to a Text file 5.5. Merging data
6.0. Study of Application packages 6.1. Introduction to application oriented software packages 6.2. Study of Railway reservation Package 6.3. Study of different modules and menus available in online Railway Reservation Package 6.4. Study of Banking packages 6.5. Study of Library Management packages 6.6. Study of Inventory control packages 6.7. Study of School Management Packages	6.0. Practice 6.1. Collection of different trial packages 6.2. Visiting Organizations to collect different formats and procedures used in the system 6.3. Creating forms and Reports for the different packages using appropriate data bases
7.0. Project work 7.1. Understand the concept of making projects and preparing the project reports. 7.2. Visiting different organizations to have an idea of different packages 7.3. Preparation of a project using the software skills learned during the course.	7.0. Project Work 7.1. Making a working model/project using MS Access 7.2. Project Report

Elective – II - Business Mathematics – 1st year

(Subject Code – 90000023)

Theory	Practical
Detailed Syllabus: 1.0. Logarithms 1.1. Introduction to logarithms 1.2. Laws of logarithm, characteristics and mantissa	Practice: 1. At least 5 to 10 exercises per chapter 2. One home/class assignment per chapter
2.0. Sets, Relations and functions 2.1. Study of Relation, Function 2.2. Types of functions 2.3. Domain, Co – domain, Range of a function 2.4. Composite and Inverse functions 2.5. Graphs of functions	
3.0. Complex Numbers 3.1. Definition of complex numbers 3.2. Line	
4.0 Quadratic Equations 4.1 Nature of roots of Quadratic Equation 4.2 Sum and Product of roots of quadratic equations 4.3 Formation of Quadratic Equations 4.4 Symmetric functions of roots 4.5 Cubs roots unity	
5.0. Determinants 5.1 Determinant of order three 5.2 Applications of Determinants	
6.0. Trigonometric ratios 1.1. Angles & its measurements 1.2. Trigonometric ratios 1.3. Relation between degree and radian. 1.4. Fundamental identities. 1.5. Examples based on Fundamental Identities 1.6. Trigonometric ratios of sum and difference of two angles 1.7. Factorization formulae 1.8. Inverse trigonometric functions 1.9. Properties of a Triangle	
7.0. Plane Co-ordinate Geometry 7.1. Locus 7.2. Line	
8.0 Partition values and measure of dispersion 8.1 Partition values 8.2 Measures of Dispersion	
9.0. Moments Skewness Kurtosis 9.1 Moments 9.2. Skewness 9.3 Kurtosis	
10.0. Bivariate frequency distribution and correlation 10.1. Bivariate frequency distribution 10.2 Bivariate Correlation 10.3 Rank correlation	
11.0. Permutations and Combinations 11.1 Factorial notation 11.2 Principle of counting 11.3 Permutations 11.4 Combinations	

12.0. Probability 12.1 Types of Event 12.2 Addition Theorem 12.3 Conditional Probability	
13.0. Random Variable and Probability Distribution 13.1 Definition and Types of Random variable 13.2 Probability Distribution of random variable 13.4. Risk and uncertainty	
14.0. Commercial Arithmetic 14.1 Commission Brokerage 14.2 Discount 14.3 Insurance	

Elective – II - Business Mathematics – 2nd year

(Subject Code – 90000023)

Theory	Practical
1.Mathematical Logic 1.1 Statements and logical connectives 1.2 Statement pattern and logical equivalence 1.3 Venn Diagram	
2. Matrices 2.1 Definition and Types matrices 2.2 Algebra Matrices 2.3 Inverse of a Matrix 2.4 Solution of Equations	
3. Limit and Continuity 3.1 Definition 3.2 Algebra of limits 3.3 Application of Standard limits 3.4 Continuity of a function at a point	
4. Differentiation 4.1 definition of Derivative 4.2 Derivative from first principles 4.3 Rules of Differentiation 4.4 Derivative of composite functions 4.5 Derivative of Inverse functions 4.6 Logarithmic Differentiate 4.7 Derivates of Implicit functions 4.8 Derivatives of Parametric functions. 4.9 Second order derivatives	
5. Application of Derivatives 5.1 Increasing and Decreasing functions 5.2 maxima and Minima 5.3 Approximation and Error	
6. Integration 6.1 Definition of an integral 6.2 Integral of standard functions 6.3 Rules of Integration 6.4 Methods of Integrations Integration by parts 6.5 Definite Integrals	
7. Differential Equations 7.1 Definition 7.2 Formation of Differential Equations 7.3 Solution of first order and first degree differential equations 7.4 Applications of Differential equations	

1.Theory of Attributes 1.1 Introduction Notation and class frequencies 1.2 Consistency of data 1.3 independence of Attributes 1.4 Association of Attributes	
8. Regression Analysis 8.1 Introduction 8.2. Data and information 8.3. Tabulation of data 8.4. Graphs and diagrams, scatter diagrams, histograms, bar charts...etc 8.5 Equation of lines of regression 8.6 Regression coefficient and its properties	
9. Numerical Methods 9.1 Finite differences 9.2 Interpolation with equal intervals 9.3 Interpolation with unequal intervals 9.4 Numerical integration	
10. Discrete Probability Distribution 10.1 Binomial Theorem 10.2 Binomial Distribution 10.3 Poisson Distribution	
11. Management Mathematics 11.1 linear programming problem 11.2 Assignment problem 11.3 Sequencing	
12. Demography 12.1 Introduction, definition, Uses of vital statistics 12.2 Measurements of Mortality 12.3 Life tables	
13. Index Number 13.1 Introduction 13.2 Definition and Notations of index numbers 13.3 Types of index number 13.4 Construction of index number 13.5 cost of living index number 13.6 Uses of cost of living index number	
14.0. Spread sheets 14.1. Introduction to spread sheets 14.2. Features and functions of spread sheet softwares 14.3. Use and limitations of spread sheet softwares in business 14.4. Apply spread sheet software to the manual work of chartered management accountant.	Practice: 1. Using spread sheet package 2. Entering data in to Spread sheet 3. Making graphs the selected data using Spread sheet packages 4. Using functions and formulas 5. Making accounts using Spread sheet packages

Electronics Devices & Circuits – 1st year

Subject Code 30140001

Theory	Practical
Detailed Syllabus :	Detailed Syllabus
<p>1. Materials</p> <p>Classification of materials Conducting, semi-conducting and insulating materials through a brief reference to their atomic structure</p> <p>Conducting Materials Resistors and factors affecting resistivity such as temperature, alloying and mechanical stressing. Classification of conducting materials into low resistivity and high resistivity materials</p> <p>Insulating Materials Important relevant characteristics (electrical, mechanical and thermal) and applications of the following material. Mica, Glass, Copper, Silver, PVC, Silicon, Rubber, Bakelite, Cotton, Ceramic, Polyester, Polythene and Varnish.</p> <p>Magnetic Materials Different Magnetic materials; (Dia, Para, Ferro) and their properties. Ferro magnetism, Domains, permeability, Hysteresis loop. Soft and hard magnetic materials, their examples and typical applications.</p>	<p>Identification of Various Materials.</p> <ul style="list-style-type: none"> • Identification of Types of Resistors. • Calculation of Values using Color Codes • Wattage of Resistance • Series & parallel connection of Resistance. • Ohms Law <p>Identification of Various Insulating Materials Properties & Use.</p> <p>Identification of Various Magnetic Materials Properties & Use.</p>
<p>Components:- Capacitors Concept of capacitance and capacitors, units of capacitance, types of capacitors, constructional details and testing specifications</p> <p>a) Capacity of parallel plate capacitors, spherical capacitors, cylindrical capacitor.</p> <p>b) Energy stored in a capacitor.</p> <p>c) Concept of di-electric and its effects on capacitance, di-electric constant, break down voltage.</p> <p>d) Series and parallel combination of capacitor. Simple numerical problems of capacitor.</p> <p>e) Charging and discharging of capacitor with different resistances in circuit, concept of current growth and decay, time constant in R-C circuits, simple problems.</p> <p>Resistors: Carbon film, metal film, carbon composition, wound and variable types (presets and potentiometers)</p> <p>Transformer, inductors and RF coils: Methods of manufacture, testing, Need of shielding, application and trouble shooting</p> <p>Surface Mounted Devices (SMDs): Constructional detail and specifications.</p> <p>Connectors, Relays, switches and cables: Different types of connectors, relays, switches and cables, their symbols, construction and characteristics.</p> <p>Semi Conductors and Integrated Circuits :- Basic characteristics of Semiconductor materials, testing of diodes, transistors, FETs and SCRs. Various processes in IC manufacturing. Hybrid IC technology Superconductivity and piezoelectric ceramic transducer elements</p>	<p>Identification of Various Materials.</p> <ul style="list-style-type: none"> • Identification of Types of Capacitor. • Calculation of Values using Color Codes • Wattage of Capacitor Series & parallel connection of Capacitor. <p>Identification of various SMD</p> <p>Identification of Relay, Switches & Cables & its Testing.</p> <p>Identification of Various Electronics Components.</p> <p>Lead Identification.</p>

<p>Basics of Measurements Measurement, method of measurement, types of instruments:- Specifications of instruments: Accuracy, precision, sensitivity, resolution, range, errors in measurement, sources of errors, limiting errors loading effect, requirements, importance and applications of standards, calibration</p> <p>Multimeter Principles of measurement of DC voltage, DC current, AC voltage, AC current, moving coil and moving iron type instruments (voltmeter and Ammeter) Block diagram of multimeter and measurement of voltage, current and resistance using multimeter Specifications of multimeter and their applications. Limitations with regard to frequency and input impedance.</p> <p>Electronic Voltmeter Advantages over conventional multimeter for volt measurement with respect to input impedance and sensitivity. Principles of voltage, current and resistance measurement (block diagram only) Specifications of electronics voltmeter</p> <p>AC Milli Voltmeter Types of AC milli voltmeters and their block diagram description Typical specifications and their significance.</p> <p>Cathode Ray Oscilloscope Construction and working of different blocks used in CRT Time base operation and need for blanking during fly back, synchronization Block diagram description of a basic CRO and triggered sweep oscilloscope, front panel controls Specifications of CRO and their explanation Measurement of current, voltage, frequency, time, period and phase uses CRO. CRO probes, special features of dual beam, dual trace, delay sweep Digital storage oscilloscope: block diagram and working principle.</p> <p>Signal Generators and Analysis Instruments Explanation of block diagram specifications of low frequency and RF generators, pulse generator, function generator Distortion factor meter; wave analyser and spectrum analyser</p> <p>Impedance Bridges and Q Meters Wheat stone bridge AC bridges: Maxwell's induction bridge, Hay's bridge, De-Sauty's bridge, Schering bridge and Anderson bridgeBlock diagram description of laboratory type RLC bridge, specifications of RLC bridgeBlock diagram and working principle of Q meter.</p> <p>Digital Instruments Comparison of analog and digital instruments Working principle of ramp, dual slope and integration type digital voltmeter. Block diagram and working of a digital multimeter Measurement of time interval, time period and frequency using universal counter/frequency counter. Working principle of logic probe, logic pulser, logic analyzer, logic comparator, signature analyzer and logic analyzer.</p>	<ol style="list-style-type: none"> 1. To observe the loading effect of a multimeter while measuring voltage across a low resistance and high resistance 2. To observe the limitations of a multimeter for measuring high frequency voltage 3. Measurement of voltage, frequency, time period and phase using CRO 4. Measurement of rise time and fall time using CRO 5. Measurement of Q of a coil and its dependence on frequency 6. Measurement of voltage, frequency, time and phase using DSO 7. Measurement of resistance and inductance of coil using RLC meter 8. Measurement of distortion of RF signal generator using distortion factor meter 9. Use of logic pulser and logic probe 10. Measurement of time period, frequency, average period using universal counter/frequency counter 11. Study of operation and features of a logic analyzer
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Electronics Devices & Circuits – 2 nd year	
Subject Code 30140001	
BASIC ELECTRICAL AND ELECTRONICS Safety precautions and elementary First aid, Identification, uses and maintenance of hand tools, DC & AC current, terms and definitions used in circuits , frequency, waveform Measurement of AC & DC using Ammeter / Voltmeter , AC power, power factor, work, power & Energy - their units and measurements , Identification of AC / DC meters, Kirchoff's law, Ohms law, electric power and dissipation in resistance, IR voltage drops. Define magnetism, unit of measurement, types of magnetic properties, Magnet and its classification, materials used & its application, mutual & self inductance, unit of measurement, BH curve. Passive Components : Resistor -definition, types of resistors, their construction & specific use, color-coding, power rating,. Series /parallel combination of resistances and measurement of current in branches. Capacitance – define, construction, types of capacitors, color coding charge/energy stored in capacitor, capacitive reactance, series/ parallel combination of capacitors Inductors-define ,types & their application, series and parallel combination, Q factor, Current carrying conductor, Fleming rule Electromagnets –define, Solenoids & relays define ,construction & its application. Working principle , construction of Transformers & their types, various losses of transformers. RC,RL, RLC Circuits, Series and parallel resonance Electrons and protons in an atom, Structure of atom, valance & conduction electron, Conductors, Insulators, Semiconductors, charge in motion-current, units, electron flow, motion of +ve charge, Semiconductors, Crystal structure and bonds, Intrinsic & extrinsic semiconductors, N- type, P-type, Free electron & Hole charges, Fixed ion charges, The P-N junction, Barrier potential, Forward & Reverse voltage, Effect of temp., V-I characteristic, Special purpose diodes and symbols. Rectifier types i.e. Half-wave, full-wave & bridge rectifiers, measurement of different currents i.e. Im, Idc, Irms, d.c. out put voltage, efficiency, filter circuits and their types, i.e. capacitor input filter, Choke input filter, etc, Junction break down, Zener break down, Zener diode, Forward & Reverse bias, Voltage regulation using Zener diode ,Zener regulators	<ul style="list-style-type: none"> • Identification of various Hand tools used • Identification of different types of cables, SWG practice. • Measure the power , power factor and energy in different circuits. • Construct & verify Ohm's law. • Construct and verify Kirchoff's voltage law. Tracing the magnetic field of Bar magnet using compass. • Identification of different resistors i.e. carbon, wire-wound, variable, pot., preset, Rheostat etc. • Color-coding of resistors ,Construct a series & parallel resistor circuits • Identification of capacitor and their codes, construct the series /parallel circuit of capacitor • Identification of inductor , construct the series /parallel circuit of inductor. • Identification of capacitor and their codes, construct the series /parallel circuit of capacitor • Construct an electromagnet and test it. • Testing and construction of different types relays. • Identification and testing of different types of transformers, measure the O/P voltage. • Identification of anode, cathodes of different types of diodes. • Study the specifications of a semiconductor diode using a data sheet • Construct a forward bias and a reverse bias circuit and plot V-I characteristic of diode • Construct a half wave rectifier, full wave (center tapped) rectifier and full wave (Bridge) rectifier. • Observe wave forms with/ without using filter. • Study the specifications of zener diode using data sheet. • Construct the Zener regulator circuit • Series parallel combination of batteries • Charging of batteries, maintenance of batteries • Calculate the shorted load and matched load current for given cell

<p>Battery: Electrochemical action, define symbol, types of cell, construction, principle charging ,specific gravity (Amp-hr capacity) specification of battery classification of battery, application, , service needs, storage, , lead acid battery ,. ideal voltage source, real voltage source, shorted load current, matched load current, Current source.</p>	
<p>Three Phase Supply Advantages of 3 phase system over single phase system Star delta connections Relation between phase voltage and line Voltage, also between phase current and line current in a 3 phase system Power and power factor in 3 phase system and their measurements Transformer Principles of transformer, construction, voltage and current transformation. Methods of connection 3 phase transformers, current and voltage relationship, auto transformer and its uses, instruments transformer, voltage regulation and its significance, need for isolation, electrical and transients suppression, principles of isolation transformer, specifications of all types of transformers. Losses in a transformer. DC Motor Principles, significance of back emf, types of motors and their constructions, motor characteristics for shunt and series, speed control of DC motors and factors controlling the speed. Starting methods, Construction and working of 3 point starter, applications (simple problems) Single Phase Motors Principles, construction, working speed control, starting and applications of the following motors Induction motor, Universal motor. Stepper Motor and Servo Motor Types, construction, working and their applications</p>	<p>Introduction to electrical machines Measurement of the angular displacement of rotor of the three phase synchronous machine with respect to the stator on application of DC to the field winding and simultaneously to each phase-winding in sequence DC machines Speed control of dc shunt motor (i) Armature control method (ii) Field control method Study of dc series motor with starter (to operate the motor on no load for a moment). Transformers (single phase) To perform open circuit and short circuit test for determining parameter of a transformer To determine the regulation and efficiency from the data obtained from open circuit and short circuit test Three-phase transformers Checking the polarity of the windings of a three phase transformer and connecting the windings in various configurations.</p>

RECOMMENDED BOOKS

- Basic Electronics and Linear Circuits by NN Bhargava, Tata McGraw Hills, New Delhi
- Electronics Principles by Malvino, Tata McGraw Hills, New Delhi
- Electronic Devices and Circuits by Millman and Halkias, McGraw Hills, New Delhi
- Basic Electronics by Grob, Tata McGraw Hills, New Delhi
- Art of Electronics by Horowitz
- Electronic Principles by Sahdev, Dhanpat Rai and Sons, New Delhi.
- Electronic Circuit Theory by Boylestad
- Electronic Devices and Circuits by BL Theraja, S Chand and Co Ltd. New Delhi
- Operational Amplifiers and Linear Integrated Circuits by Ramakant A. Gaykwad
- Electronics Devices and Circuits by Rama Reddy, Narosa Publishing House Pvt. Ltd., New Delhi
- Electronics Devices and Circuits-II by Naresh Gupta, Jyotesh Malhotra and Harish C. Saini, Eagle Prakashan, Jalandhar
- Electronic components and Materials by Grover and Jamwal; Dhanpat Rai and Sons, New Delhi
- Basic Electronics and Linear Circuits by NN Bhargava and Kulshreshta; Tata McGraw Hill, New Delhi
- Electronic components and Materials by SM Dhir, Tata McGraw Hill, New Delhi
- Electrical and Electronic Engineering Materials by SK Bhattacharya, Khanna Publishers, New Delhi
- Electronic Engineering Materials by ML Gupta, Dhanpat Rai and Sons; New Delhi.
- Electrical Machine by SK Bhattacharya, Tata McGraw Hill, New Delhi
- Electrical Machines by SK Sahdev, Unique International Publications, Jalandhar
- Electrical Machines by Nagrath and Kothari, Tata McGraw Hill, New Delhi
- Electronics Measurement and Instrumentation by AK Sawhney, Dhanpat Rai & Sons, Delhi
- Electronics Instrumentation by Cooper, Prentice Hall of India
- Electronics Test and Instrumentation by Rajiv Sapra, Ishan Publications, Ambala
- Electronics Instrumentation by JB Gupta, Satya Prakashan, New Delhi

List of Tools & Equipments:-

Category	Sr. No	Name of Tool & Equipment	Quantity
Hand tools	1	Rule wooden 4 fold	25
	2	Scriber	25
	3	Pincer insulated Screw Driver Knife double bladed electrician	25
	4	Insulated handle thin connector screw driver	25
	5	Tester	25
	6	Heavy duty screw driver	25
	7	Combination plier	25
	8	Long nose plier Tweezer	25
	9	Heat sink plier	25
	10	Watch maker screw driver	25
	11	Adjustable spanner /slide wrench	25

Category	Sr. No	Name of Tool & Equipment	Quantity
Instruments and general shop out fit per unit	1	Wire stripper	4
	2	Soldering iron	4
	3	Wire gauge set	4
	4	Feeler gauge	4
	5	Permanent magnet bar	8
	6	Solenoid with core	8
	7	Electric bell	8
	8	Battery storage lead acid/Maintenance free	8
	9	Hydrometer	4
	10	Battery charger	4
	11	Rheostat variable values	8
	12	Variable resistance /potentiometer	4
	13	Transformer 500 VA	4
	14	DC& AC ammeter 0-50 uA	4
	15	DC& AC ammeter 0-500 uA	4
	16	DC& AC ammeter 0-1mA	4
	17	DC& AC ammeter 0-500 mA	4
	18	DC& AC ammeter 0-1 A	4
	19	Multimeter small & big	4 each
	20	Bread board for connecting various components i.e. diode, resistances ,capacitors etc,	8
	21	0-12 V DC ,2 Amp power supply	4
	22	Transformer 0-12 V, 6-0-6 V , 1 Amp	4
	23	Rubber gloves	8

Category	Sr. no	Name of Tool & Equipment	Quantity
<i>Furniture</i>	1	WORK BENCH / TABLE / TEST BENCH	As required
	2	REVOLVING CHAIR / STOOL [FOR PARTICIPANTS]	16
	3	STAFF TABLE	1
	4	REVOLVING CHAIR [FOR STAFF]	1
	5	STEEL RACKS	As required
	6	STEEL ALMIRAH	As required
	7	STEEL LOCKERS FOR 16 PARTICIPANTS	As required
	8	Fire Extinguisher	As required
	9	Rubber mat	As required

Analog & Digital Electronics – 1st year

Subject Code 30140002

Theory	Practical
<p>Multistage Amplifiers Need for multistage amplifier Gain of multistage amplifier Different types of multistage amplifier like RC coupled, transformer coupled, direct coupled, and their frequency response and bandwidth</p> <p>Large Signal Amplifier Difference between voltage and power amplifiers Importance of impedance matching in amplifiers Class A, Class B, Class AB, and Class C amplifiers Single ended power amplifiers, push-pull amplifier, and complementary symmetry push-pull amplifier.</p> <p>Feedback in Amplifiers Basic principles and types of feedback Derivation of expression for gain of an amplifier employing feedback Effect of feedback (negative) on gain, stability, distortion and bandwidth of an amplifier RC coupled amplifier with emitter bypass capacitor Emitter follower amplifier and its applications.</p> <p>Sinusoidal Oscillators Use of positive feedback Barkhausen criterion for oscillations Different oscillator circuits-tuned collector, Hartley Colpitts, phase shift, Wien's bridge, and crystal oscillator. Their working principles and simple numerical problems Series and parallel resonant circuits and bandwidth of resonant circuits Single and double tuned voltage amplifiers and their frequency response characteristics</p> <p>Wave Shaping Circuits General idea about different wave shapers RC and RL integrating and differentiating circuits with their applications Diode clipping and clamping circuits and simple numerical problem on the circuits.</p> <p>Multivibration Circuits working principle of transistor as switch Concept of multi-vibrator: astable, monostable, and bistable and their applications Block diagram of IC555 and its working IC555 as monostable and astable multi-vibrator.</p> <p>Operational Amplifiers Characteristics of an ideal operational amplifier and its block diagram Definition of differential voltage gain, CMMR, PSRR, slew rate and input offset current Operational amplifier as an inverter, scale changer, adder, subtractor, differentiator, and integrator Concept of Schmitt trigger circuit and sample/hold circuit using operational amplifier and their applications.</p> <p>Regulated DC Power Supplies Concept of DC power supply. Line and load regulation Concept of fixed voltage, IC regulators (like 7805, 7905), and variable voltage regulator like (IC 723) Idea of SMPS.</p>	<ol style="list-style-type: none"> Plot the frequency response of two stage RC coupled amplifier and calculate the bandwidth and compare it with single stage amplifier To measure the gain of push-pull amplifier at 1KHz To measure the voltage gain of emitter follower circuit and plot its frequency response Plot the frequency response curve of Hartley and Colpitts Oscillator Plot the frequency response curve of phase shift and Wein bridge Oscillator To observe the output waveforms of series and shunt clipping circuits To observe the output for clamping circuits To observe the output waveform of a Bistable multivibrator Use of IC 555 as monostable multivibrator and observe the output for different values of RC Use of IC 555 as astable multivibrator and observe the output at different duty cycles To use IC 741 (op-amplifier) as <ol style="list-style-type: none"> Inverter Adder Subtractor Integrator To realize positive and negative fixed voltage AC power supply using three terminal voltage regulator IC (7805, 7812, 7905)

RECOMMENDED BOOKS

1. Basic Electronics and Linear Circuits by NN Bhargava, Tata McGraw Hills, New Delhi
2. Electronics Principles by Malvino, Tata McGraw Hills, New Delhi
3. Electronic Devices and Circuits by Millman and Halkias, McGraw Hills, New Delhi.
4. Basic Electronics by Grob, Tata McGraw Hills, New Delhi
5. Art of Electronics by Horowitz
6. Electronic Principles by Sahdev, Dhanpat Rai and Sons, New Delhi.
7. Electronic Circuit Theory by Boylestad
8. Electronic Devices and Circuits by BL Theraja, S Chand and Co Ltd. New Delhi
9. Operational Amplifiers and Linear Integrated Circuits by Ramakant A. Gaykwad
10. Electronics Devices and Circuits by Rama Reddy, Narosa Publishing House Pvt. Ltd., New Delhi
11. Electronics Devices and Circuits-II by Naresh Gupta, Jyotesh Malhotra and Harish C. Saini, Eagle Prakashan, Jalandhar

Analog & Digital Electronics – 2nd year**Subject Code 30140002**

Theory	Practical
<p>Introduction Define digital and analog signals and systems, difference between analog and digital signals Need of digitization and applications of digital systems.</p> <p>Number Systems Decimal, binary, octal, hexadecimal number systems Conversion of number from one number system to another including decimal points Binary addition, subtraction, multiplication, division, 1's and 2's complement method of subtraction BCD code numbers and their limitations, addition of BCD coded numbers, conversion of BCD to decimal and vice-versa Excess-3 code, gray code, binary to gray and gray to binary conversion Concept of parity, single and double parity, error detection and correction using parity.</p> <p>Logic Gates Logic gates, positive and negative logic, pulse waveform, definition, symbols, truth tables, pulsed operation of NOT, OR, AND, NAND, NOR, EX-OR, EX-NOR gates. NAND and NOR as universal logic gates.</p> <p>Logic Simplification Rules and laws of Boolean algebra, logic expression, Demorgan's theorems, their proof Sum of products form (minterm), Product of sum form (maxterms), simplification of Boolean expressions with the help of Rules and laws of Boolean algebra Karnaugh mapping techniques upto 4 variables and their applications for simplification of Boolean expression.</p> <p>Arithmetic Circuits Half adder, full adder circuits and their operation Parallel binary adder, 2-bit and 4-bit binary full adder, block diagram, working.</p> <p>Multiplexer/Demultiplexer Basic functions, symbols and logic diagrams of 4-inputs and 8-inputs multiplexers, Function/utility of 16 and 32 inputs multiplexers, Realization of Boolean expression using multiplexer/demultiplexers.</p> <p>Decoders, Display Devices and Associated Circuits Basic Binary decoder, 4-line to 16 line decoder circuit BCD to decimal decoder, BCD to 7-segment decoder/driver, LED/LCD display.</p> <p>Encoders and Comparators Encoder, decimal to BCD encoder, decimal to BCD priority encoder, keyboard encoder Magnitude comparators, symbols and logic diagrams of 2-bit and 4-bit comparators.</p>	<ol style="list-style-type: none"> 1. Study of logic breadboard with verification of truth table for AND, OR, NOT, NAND, EX-OR, NOR gate 2. Verification of NAND and NOR gate as universal gates 3. Construction of half-adder and full adder circuits using EX-OR and NAND gate and verification of their operation 4. Verify the operation of <ol style="list-style-type: none"> a) multiplexer using an IC b) de-multiplexer using an IC 5. <ol style="list-style-type: none"> a) Verify the operation of BCD to decimal decoder using an IC b) Verify the operation of BCD to 7 segment decoder using an IC

Latches and Flip-Flops Latch, SR-latch, D-latch, Flip-flop, difference between latch and flip-flop S-R, D flip-flop their operation using waveform and truth tables, race around condition JK flip-flop, master slave and their operation using waveform and truth tables. Counters Asynchronous counter, 4-bit Asynchronous counter, Asynchronous decade counter Asynchronous counter, 4-bit synchronous binary counter, Asynchronous decade counter Up/down Asynchronous counters, divide by N counter MOD-3, MOD-5, MOD-7, MOD-12 counters Ring counter, cascaded counter, counter applications Shift Registers Shift registers functions, serial-in-serial out, serial-in-parallel-out, parallel-in-serial-out, parallel-in-parallel out Universal shift register, shift register counter and applications of shift registers.	6. Verify operation of SR, JK, D-flip-flop master slave JK flip-flop using IC 7. Verify operation of SISO, PISO, SIPO, PIPO shift register. (universal shift register) 8. Study of ring counter, Up/down counter 9. Construct and verify the operation of an asynchronous binary decade counter using JK flip-flop 10. Verification of truth tables and study the operation of tristate buffer IC 74126 or similar IC and construction of 4/8 bit bi-directional bus by using an IC 11. Testing of digital ICs using IC tester
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RECOMMENDED BOOKS:- 1. Digital Electronics and Applications by Malvino Leach, Tata McGraw Hill, New Delhi 2. Digital Logic Designs by Morris Mano, Prentice Hall of India, New Delhi 3. Digital Fundamentals by Thomas Floyds, Universal Book Stall 4. Digital Electronics by RP Jain, Tata McGraw Hill, New Delhi 5. Digital Electronics by KS Jamwal, Dhanpat Rai & Co., New Delhi 6. Digital Electronics by Rajiv Sapra, Ishan Publication, Ambala 7. Digital Electronics by BR Gupta, Dhanpat Rai & Co., New Delhi 8. Digital Systems: Principles and Applications by RJ Tocci, Prentice Hall of India, New Delhi 9. Digital Electronics by Rajaraman V., Prentice Hall of India, New Delhi

Tools & Equipments:---

Category	Sr. No	Name of Tool & Equipment	Quantity
Hand tool	1	Rule wooden 4 fold	25
	2	Scriber	25
	3	Pincer insulated Screw Driver Knife double bladed electrician	25
	4	Insulated handle thin connector screw driver	25
	5	Tester	25
	6	Tweezer	25
	7	Combination plier	25
	8	Long nose plier	25
	9	Heat sink plier	25
	10	Watch maker screw driver	25
	11	Adjustable spanner /slide wrench	25
	12	Soldering iron	25
	13	Digital Multimeter 3 ½ digit	25

Category	Sr. No	Name of Tool & Equipment	Quantity
Instruments and general shop out fit per unit	1	Basic Electronics Trainer for conducting practical of LDR, Transistorized Amplifier and Oscillators with bread board facility for connecting components & DC regulated power supply for the experiment along with different passive components on board . Necessary current meters and Volt meters should also be provided	5
	2	Linear IC trainer for conducting practical of 741& 723 Op-AMP with bread board facility for connecting components & DC regulated power supply for the experiment along with different passive components on board . Necessary current meters and Volt meters should also be provided	5
	3	Power Electronic trainer for conducting practical of UJT, FET. SCR. DIAC, TRIAC, MOSFET, OPTO COUPLER with bread board facility for connecting components & DC regulated power supply for the experiment along with different passive components on board . Necessary current meters and Volt meters should also be provided	5
	4	SMPS trainer (IC & Transistorized based) with various test points for check the voltage and wave form having 4 O/P 110v,24V,12V,5 V	5
	5	Power supply trainer having facility of IC regulators using 78 & 79 series	5
	6	Bread board	8
	7	Oscilloscope 20 MHz with probes	4
Instruments and general shop out fit per unit	8	Oscilloscope 50MHz with probes	2
	9	Electronic Multimeter	8
	10	Function generators 0.1 Hz to 100KHz Sine Square,Triangular	5
	11	Pulse generator	5
	12	Sine wave generator	5
	13	Audio frequency generator	5
	14	Signal generator	5
	15	Digital Multimeter	5
	16	Magneto scope	2
	17	Soldering iron 25Watt	4
	18	1200 VA Inverter	1
	19	0-12 V DC regulated Power supply	4
	20	Auto Transformer	2

Category	Sr. no	Name of Tool & Equipment	Quantity
<i>Furniture</i>	1	WORK BENCH / TABLE / TEST BENCH	As required
	2	REVOLVING CHAIR / STOOL [FOR PARTICIPANTS]	25
	3	STAFF TABLE	1
	4	REVOLVING CHAIR [FOR STAFF]	1
	5	STEEL RACKS	As required
	6	STEEL ALMIRAH	As required
	7	STEEL LOCKERS FOR 16 PARTICIPANTS	As required
	8	FIRE EXTIGUISER	As required
	9	RUBBER MAT	As required

Bio-Medical Instrumentation, Radiology & Imaging – 1st year

Subject Code 30140012

Theory	Practical
Anatomy and Physiology Elementary ideas of cell structure, heart and circulatory system, control nervous system, Musculo-skeletal system, Respiratory system Body temperature and reproduction system.	1. Minimum of eight exercises to be carried out and one field visit 2. Operation and function of all the controls of hospital X-Ray machine (visit at hospital)
Classification of Biomedical Equipment Diagnostic, therapeutic and clinical laboratory equipment	3. Operation and function of all the controls of dental X-Ray machine (Visit to Hospital)
Bioelectric signals and their recording Bioelectric signals (ECG, EMG, ECG, EOG & ERG) and their characteristics, Bioelectrodes, electrodes tissue interface, contact impedance, effects of high contact impedance, types of electrodes, electrodes for ECG, EEG and EMG.	3. Identification of different block/sub system of circuits in X-Ray machine 5. Measurement of skin contact impedance and technique to reduce it.
Transducers for Biomedical Application Resistive transducers - Muscle force and Stress (Strain gage), Spirometry (Potentiont), humidity, (Gamstrers), Respiration (Thermistor)	6. Observe its wave shape on CRO the output of blood pressure transducers body temperature transducers and pulse sensors
Inductive Transducers - Flow measurements, muscle movement (LVDT) Capacitive Transducers - Heart sound measurement, Pulse pick up Photoelectric Transducers - Pulse transducers, Blood pressure, oxygen Analyses Piezoelectric Transducers - Pulse pickup, ultrasonic blood flowmeter Chemcial Transducer - Ag-Agfallas (Electrodes, PH electrode	7. Use of sphygrmanometer for measurement of blood pressure. 8. Concept of ECG system and placement of electrodes
Bioldectric Signal recording machines Physiological pre-amplifier and specialized amplifiers, ECG lead systems details of ECG, EMG, and EEG machines	9. Measurement of leakage currents with the help of safety tester 10. PH measurement of given biological sample
Patient Monitoring system Heart rate measurement pulse rate measurement, respiration, rate measurement, blood pressure measurement, microprocessor applications in patient monitoring	11. Concept of EMG system and placement of electrode 12. Measurement of respiration rate using thermistor
X- Ray Machine Basic X-Ray components and circuits, types of X-ray machines e.g. general purpose, dental image intensifier system, table shooting and maintenance of X- Ray machine	13. Concept of EEG system and placement of electrode
Safety Aspect of Medical Gross current, Micro Current shock, safety standards rays and considerations, safety testing instruments, biological effects of X-rays and precautions	14. Identification of different types of PH electrode

RECOMMENDED BOOKS:-

1. Medical Instrumentation by John. G. Webster –John Wiley
2. Principles of Applied Biomedical Instrumentation by Goddes & Baker – John Wiley
3. Biomedical Instrumentation & Measurement by Carr & Brown-Pearson
4. Biomedical Instrument by Cromwell-Prentice Hall of India, New Delhi
5. Hand book of Medical instruments by R.S. Khandpur –TMH, New Delhi
6. Medical Electronics and Instrumentation by Sanjay Guha – University Publication
7. Introduction to Biomedical electronics by Edward J. Bukstein –sane and Co. Inc. USA Inc., New Delhi
6. Principles of Industrial Process Control; by Eckman, Donal P; John Wiley and Sons
7. Process Measurement and Analysis, third edition by Liptak Bila G

Bio-Medical Instrumentation, Radiology & Imaging - 2nd year**Subject Code 30140012**

Theory	Practical
Machine used or Medical Diagnosis Introduction of X-ray machine and applications in medical diagnosis. 1 X-Ray circuits (parts of X-rays), Block diagram of X-Ray machine. 2 Types of X-rays machine as per their use <ol style="list-style-type: none"> 1. General purpose X-rays 2. Digital X-rays 3. Mobile X-rays 2.1 X-rays procedure and processing 2.2 Safety by BARC norms dark room preparation and x-rays films production method, their reading, Kodak, Fuji, Niueplus films 2.3 Maintenance of X-ray machines 2.4 Safety aspects of X-rays machine, correct operation of control, kv and mA, Exposure table, precautions in the use of X-rays machine. 2.5 Study of products/ machines of Leading manufactures-Siemens, Wipro, GE and BARC (Bhaba Atomic Research Centre), Mumbai-machines.	1. Demonstration front panel control and operation of X-ray machine 2. Identification of components of x-ray machine and interconnection. 3. Identification of different P.C.B cards and their function, testing, circuit tracing. 4. Fault finding in x-ray machine 5. Developing of x-ray films in dark room
2. Ultrasound Scanners <ul style="list-style-type: none"> • Introduction of ultrasonic scanners • Specifications and control parameters, principle and working. • Generation and detection of ultrasonic • Transducers used (probe); sector (mechanical technology) • Block diagram of ultrasonic machine and its description • A-Scan and B scan (m Mode) for cardiologist • Basic introduction of color Doppler scanner • Block diagram of center Doppler scanner • Ultrasonic output taken- multi format camera (MFT), inkjet printer, laser printer, thermal printer. • Study of products/ machines Leading manufacture Wipro, GE, Toshiba, L& T, Medison. 	6. Demonstration of front panel and rear panel control and operation of Ultrasonic machine. 7. Identification of different PCB cards used in the ultrasonic machine

3. C.T. Scanner <ul style="list-style-type: none"> • Introduction of C.T. Scanner • Block diagram of C.T. Scanner • Different types of C.T. Scanners • Tour to hospital for exposure to C.T. Scanner • Application of C.T. Scanner • Leading manufacturer Siemens, Toshiba, G.E. 	8. Familiarization with different probes sector and electronic 9. Demonstration and operation of computer-controlled ultrasonic scanner (Color Doppler) 10. Troubleshooting of various common faults in Color Doppler Machine
MRI (Magnetic Resonance Imaging) <ul style="list-style-type: none"> • Introduction of MRI • Block diagram of MRI • Different type of MRI • Application of MRI • Leading manufacturer - G.E. Scanner 	11. Demonstration of working of CT scanners in Hospital 12. Demonstration of MRI in Hospital diagnostic center 13. General fault finding and trouble shooting
RECOMMENDED BOOKS:-	
1. Handbook of Biomedical Engineering – IEEE Press 2. Introduction to Biomedical Equipment Technology – Joseph J. Carr and John M Brown. 3. Principles of Biomedical Instrumentation and measurement – Richard Aston.	

LIST OF TOOLS & EQUIPMENTS

NUMBER OF UNITS ONE (25 trainees)

(A)

TRAINEES TOOL KIT

STANDARD LIST OF TOOLS EQUIPMENTS AND FURNITURE (FOR BIO-MEDICAL COURSES)			
CARDIOLOGY LAB.			
Sr.No.	Description of Equipment/Tools	Qty. Nos./Sets	Remarks
1.	ECG Machine Interpretative	02	
2.	Digital Multimeter	03	
3.	Soldering Iron	04	
4.	UPS (on-line) 5 KVA with unserviceable battery back up for 3 hours and battery stand	01	
LABORATORY/CLASS-ROOM FURNITURE			
5.	Laboratory Table	10	
6.	Class Room Chair	35	
7.	Lecture Stand	02	
8.	White Board (Magnetic) with moveable stand	02	
9.	Steel Almirah/Storage Cabinet	08	
10.	Book Shelf/Book Case	04	
11.	Table for staff	02	
12.	Chair for staff with fabric cushioned seat and back revolving arms and adjustable height student/visitor chairs	02	

X-RAY & IMAGINE LAB			
11.	Portable X-Ray machine with standard accessories	02	
12.	3—mA- X-Ray system with Fluoroscopy	01	
13.	Dental X-Ray system	02	
14.	Dosimeter	02	
15.	Dark room accessories for X-ray for developing	01	
16.	Radiation protection Apron	As per need	
17.	Ultrasound scanning machine	03	
18.	Orthopento Graphy Machine	01	
19.	Telemetering System & ECG	01	
20.	UPS (on-Line) 5 KVA with unserviceable battery back-up for 3 Hours, Battery stand	01	
21.	Compute (Latest) with HDD FDD CD writer/Reader scanner Mouse Multimedia with 400w Speakers & Mic Camera Monitor 20"	02	
22.	Digital Foetal Doppler	02	
23.	Ultrasonic Doppler	01	

Sr. No.	<i>Name of Items</i>	<i>No.s Required</i>
1.	Measuring Tape Steel 100cm	25 Nos.
2.	Rule Steel 300cm	25 Nos.
3.	Screw Driver heavy duty 200mm insulated thick	25 Nos.
4.	stem	25 Nos.
5.	Screw Driver heavy duty 250mm with insulated	25 Nos.
6.	thick stem handle	25 Nos.
7.	Plier Insulated combination 200 mm	25 Nos.
8.	Knife double blade electrician 100mm	25 Nos.
9.	Pincer 150mm	25 Nos.
10.	Scriber 150mm x 4mm	25 Nos.
11.	Punch center 150mm x 8mm	25 Nos.
12.	Hammer ball pien 0.75kg with handle	25 Nos.
13.	Hammer cross pien 115gms with handle	25 Nos.
14.	Saw Tenon 250mm	25 Nos.
15.	Firmer chisel wood 12mm	25 Nos.
16.	Gimlet 6mm	25 Nos.
25.	Bradawl 100mm	25 Nos.
	Wire stripper 150 mm	25 Nos.
	Heat sink plier	25 Nos.

TRAINEE'S PERSONAL TOOL KIT		Quantity Required	
1	Voltage sensor (pencil type)/ Electronic Tester	1 No	To be brought by Trainees.
2.	Screw Driver Kit (Set of six blades with common	1 No	
3.	insulated handle with neon tester)	1 No	
4	Plier insulated 150 mm	1 No	
5.	Multimeter	1 No	
	Soldering iron,15W,230 V(temperature controlled)	1 No	

List of Tools & Equipments of Workshop

S.No.	Name of Item	Quantity
1.	Screw Driver 100 mm with handle	4 Nos.
2.	Screw driver kit (set of six blades with	4 Nos.
3.	common insulated handle)	4 Nos.
4.	Screw Driver 150 mm with insulated handle	4 Nos.
5.	Plier insulated 200 mm	4 Nos.
6.	Plier round nose 100 mm	4 Nos.
7.	Tweezer 100 mm	4 Nos.
8.	Wire striper 200 mm	2 Nos.Each.
9.	Soldering iron 25 watt , 65 watt ,250 watt	2 Nos.
10.	Desoldering pump.	2 Nos.
11.	Soldering gun	2 Nos.
12.	Soldering iron 250 watt.	1 No.
13.	Drill machine electric portable 0 to 6mm	1 set.
14.	capacity	4 Nos.
15.	Allen Key	1 No.
16.	Oil cane 0.12 liter	1 No.
17.	Grease gun (small size).	2 Nos.
18.	Grinder Bench Motorised	4 Nos.
19.	Hammer hard plastic with handle	1 set.
20.	Hammer Ball Pein 0.4 Kg.	4 Nos.
21.	Spanner Kit (Double ended).	4 Nos.
22.	Hacksaw frame 300mm	4 Nos.
23.	Hacksaw frame 200mm	1 set.
24.	Snip straight 150mm	2 Nos.
25.	Drill SS twist block (2 mm – 8 mm)	2 Nos.
26.	File flat 200mm smooth	2 Nos.
27.	File round 200mm 2 nd cut	2 Nos.
28.	File half round 250mm.	4 Nos.
29.	File triangular 150mm	2 Nos.
30.	Vice hand 50mm jaw	2 Nos.
31.	Vice table 150 mm jaw	2 Nos.
32.	Pipe cutter to cut 5cm dia.	2 Nos.
33.	Crimping Tool	1 No.
34.	Multi meter (digital)	2 Nos.
45.	Ammeter AC, 0 –1 A .	2 Nos.
36.	Ammeter M.I. 0 – 5 – 10 – 15 A	1 No.
37.	Voltmeter M.I. 0 – 150 – 300 – 600 V	1 No.
38.	Wheat stone measuring Bridge (complete	1 No.
39.	with galvanometer and Battery)	1 set.
40.	Power electronics Trainer	1 No.
41.	Microprocessor Trainer Kit	1 No.
42.		1 No.

Sr.No.	Description of Equipment/Tools	Qty. Nos./Sets	Remarks
24.	Computer (Latest) with HDD/CD Writer/Reader/Scanner/Mouse/Multimedia with Speakers and Mic/Camera.02		
25.	Digital Multimeter	12	
26.	Dual Trace Digital Oscilloscope (Storage)	05	
27.	Adjustable AC/DC Power Supply	As per Trg. Needs	
28.	Multimedia Projector	01	
29.	OHP	01	
30.	Large Screen Colour TV (High CVD/DVD Recorder (to record/play trg.Infs.)	01	
31.	Laser Colour Printer	01	
