

AC 11-05-2017

Item No.

UNIVERSITY OF MUMBAI'S**Syllabus for Approval**

Sr. No.	Heading	Particulars
1	Title of the Course	BACHELOR'S IN BIOMEDICAL INSTRUMENTATION (B. Sc. Biomedical Instrumentation)
2	Eligibility for Admission	10+2 science subjects- Physics, Chemistry, Mathematics (PCM) / Physics, Chemistry, Biology (PCB)/PCMB/vocational electronics or IT at 11 th and 12 th Admissions of the basis of written test and interview
3	Passing Marks	50% PASSING MARKS
4	Ordinances / Regulations (if any)	
5	No. of Years / Semesters	THREE YEARS FULL TIME/ 6 SEMESTER
6	Level	BACHELOR'S
7	Pattern	YEARLY / SEMESTER
8	Status	New
9	To be implemented from Academic Year	From Academic Year 2017-18

Date: 11/05/2017

Signature :

Dr. Anil Karnik, I/C. Director, Garware Institute of Career Education & Development



UNIVERSITY OF MUMBAI'S



GARWARE INSTITUTE OF CAREER EDUCATION & DEVELOPMENT

Syllabus for the

BACHELOR'S IN BIOMEDICAL INSTRUMENTATION

(B. Sc. Biomedical Instrumentation)

Credit Based Semester and Grading System with effect from the Academic Year

(2017-2018)

Introduction

This is an undergraduate Biomedical Instrumentation Science course. This is an allied health profession course. It is concerned with the basic understanding of procurement methods, installation and maintenance of the medical instruments. The course also deals with the collection of information needed, supervision of installation commissioning, testing, reporting and documentation of these instruments. **Biomedical Instrumentation Science** is three years duration course. The syllabus of the course is divided into three years and is career orienting in nature.

Need for this course:

The college is situated in a hilly area. The three districts namely Sindhudurga, Ratnagiri and Raigad which are the main feed areas. There are approximately 100+ hospitals run by government, public trusts and private ones. Apart from these there are several small setups. For every setup at least one technical person is required who has the basic knowledge of instruments. He should be capable of taking responsibility of procuring new equipment, finding resources, installation and commissioning, everyday reporting and documentation, preventive and predictive maintenance.

Considering the number of setups there is need of at least 300 such technical assistants. If a batch of 30 students is considered, there will be continued requirement for next ten years. The students can also be absorbed in industry related to biomedical instruments for equipment testing, marketing and sales, installation technicians etc. The students can also start their own maintenance service.

Advantages of the course:

This degree course will empower the students to go for various private and government hospitals, Government institutes as they will be able to manage laboratory, at clinic level, Imaging labs, radiotherapy labs etc. This enables the degree holder to go for higher degree program in respective subjects for Masters degree and later for advance studies.

They can also obtain jobs in industry as medical instrumentation technologists are required there for positions in product development, marketing, sales, quality assurance, environmental health.

OBJECTIVE : The aim of this program is:

- **To empower the students to be able to manage laboratory at clinic level**
- **To prepare the students to be able to manage Imaging labs, radiotherapy labs etc.**
- **To enables the degree holder to go for higher degree program in respective subjects for Masters degree and later for advance studies.**
- **To prepare the students for obtaining jobs in industry as medical instrumentation technologists for positions in product development, marketing, sales, quality assurance, environmental health.**

JOB OPPORTUNITIES :

- Laboratory instrument technical assistant
- Technology manager
- Laboratory manager
- Research associate
- Medical record technician
- Laboratory assistant

SYLLABUS – SEMESTER WISE

BACHELOR'S IN BIOMEDICAL INSTRUMENTATION

(THREE YEARS FULL TIME)

	Subject Code	Core Subject	Assessment Patterns			Teaching Hours			Total Credits
			Internal Marks 60	External Marks 40	Total Marks (CA) 100	Theory Hours	Practical hours	Total Hours	
Semester-1	1.1	Foundation course – I	60	40	100	45			3
	1.2	Chemical Science - I	60	40	100	45			3
	1.3	Physical Science – I	60	40	100	45			3
	1.4	Biological Science – I	60	40	100	45			3
	1.5	Mathematical Science – I	60	40	100	45			3
	1.6	Computer Science – I	60	40	100	45			3
	1.7	Analog Devices and Circuits	60	40	100	45			3
	1.8	Physical Sc. And Mathematical Sc. Practical	60	40	100		90		3
	1.9	Biological Sc and Chemical Sc Practical	60	40	100		90		3
	1.10	Computer Sc. And Instrumentation Sc. Practical	60	40	100		90		3
		Total		600	400	1000	315	270	
Semester – 02	2.11	Foundation course – II	60	40	100	45			3
	2.12	Chemical Science – II	60	40	100	45			3
	2.13	Physical Science – II	60	40	100	45			3
	2.14	Biological Science –II	60	40	100	45			3
	2.15	Mathematical Science -II	60	40	100	45			3
	2.16	Computer Science – II	60	40	100	45			3
	2.17	Sensors and transducers	60	40	100	45			3

	2.18	Physical Sc. And Mathematical Sc. Practical	60	40	100		90		3
	2.19	Biological Sc and Chemical Sc, Practical	60	40	100		90		3
	2.20	Computer Sc. And Instrumentation Sc. Practical	60	40	100		90		3
		Total	600	400	1000	315	270		30
Semester 3									
	3.21	Foundation course – III	60	40	100	45			3
	3.22	Chemical Science – III (Bio Materials-I)	60	40	100	45			3
	3.23	Physical Science – III (Medical Biophysics)	60	40	100	45			3
	3.24	Biological Science –III (Anatomy-II)	60	40	100	45			3
	3.25	Mathematical Science – III	60	40	100	45			3
	3.26	Computer Science – III (Concepts of Networking and OS)	60	40	100	45			3
	3.27	Operational Amplifiers	60	40	100	45			3
	3.28	Physical Sc. And Mathematical Sc. Practical	60	40	100		90		3
	3.29	Biological Sc and Chemical Sc, Practical	60	40	100		90		3
	3.30	Computer Sc. And Instrumentation Sc. Practical	60	40	100		90		3
		Total	600	400		315	270		30
Semester 4									
	4.31	Foundation course – IV	60	40	100	45			3
	4.32	Chemical Science – IV (BioMaterials-II)	60	40	100	45			3

	4.33	Physical Science – IV (Photonics in Biomedical instruments)	60	40	100	45			3
	4.34	Biological Science –IV (Physiology-II)	60	40	100	45			3
	4.35	Mathematical Science – IV (BioStatistics)	60	40	100	45			3
	4.36	Computer Science – IV (Biomedical Image Analysis)	60	40	100	45			3
	4.37	Power Electronics	60	40	100	45			3
	4.38	Physical Sc. And Mathematical Sc. Practical	60	40	100		90		3
	4.39	Biological Sc and Chemical Sc. Practical	60	40	100		90		3
	4.40	Computer Sc. And Instrumentation Sc. Practical	60	40	100		90		3
		Total	600	400	1000	315	270		30
Semester 5	5.41	Medical Instrumentation For Vital signs	60	40	45				3
	5.42	Principles of Diagnostic and therapeutic equipments-I	60	40	45				3
	5.43	Instrumentation of Imaging techniques-I	60	40	45				3
	5.44	X-Ray Techniques-I	60	40	45				3
	5.45	Embedded systems in medicine	60	40	45				3
	5.46	Fundamentals of troubleshooting techniques	60	40	45				3

	5.47	General Proficiency	60	40	45				3
	5.48	Project Like experiments I	60	40		90			3
	5.49	Project Like experiments II	60	40		90			3
	5.50	Project Like experiments III		40		90			3
		Total		1000	315	270			30
Semester 6	6.51	Robotics and Automation in Biomedical Instrumentation	60	40		45			3
	6.52	Principles of Diagnostic and therapeutic equipments-II	60	40		45			3
	6.53	Instrumentation of Imaging Techniques-II	60	40		45			3
	6.54	X-Ray Techniques-II	60	40		45			3
	6.55	Instrumentation of Artificial Organs	60			45			3
	6.56	Wireless communication assisted Medical Instrumentation	60	40		45			3
	6.57	Reliability and Quality Control techniques	60	40		45			3
	6.58	Activities: <ul style="list-style-type: none"> • Project • Field Visits • Short term internship • Seminar • Group discussions 	60	40		270			18
		Total	600	400	1000	315 (252 clock hrs)	270 (216 clock hrs)		39

SUBJECT-WISE SYLLABUS

SEMESER - I

PAPER NO.	SUBJECT	Total hours	Total Credits
1.1	<p>Foundation Course –I</p> <p><u>Unit -1</u> Overview of Indian Society: Understand the multi-cultural diversity of Indian society through its demographic composition: population distribution according to religion, caste, and gender; Appreciate the concept of linguistic diversity in relation to the Indian situation; Understand regional variations according to rural, urban and tribal characteristics; Understanding the concept of diversity as difference. (5 lectures)</p> <p><u>Unit 2</u> Concept of Disparity- 1: Understand the concept of disparity as arising out of stratification and inequality; Explore the disparities arising out of gender with special reference to violence against women, female foeticide (declining sex ratio), and portrayal of women in media; Appreciate the inequalities faced by people with disabilities and understand the issues of people with physical and mental disabilities. (10 lectures)</p> <p><u>Unit 3</u> Concept of Disparity-2: Examine inequalities manifested due to the caste system and inter-group conflicts arising thereof; Understand inter-group conflicts arising out of communalism; Examine the causes and effects of conflicts arising out of regionalism and linguistic differences. (10 lectures)</p> <p><u>Unit 4</u> The Indian Constitution: Philosophy of the Constitution as set out in the Preamble; The structure of the Constitution-the Preamble, Main Body and Schedules; Fundamental Duties of the Indian Citizen; tolerance, peace and communal harmony as crucial values in strengthening the social fabric of Indian society; Basic features of the Constitution. (10 lectures)</p> <p><u>Unit 5</u> Significant Aspects of Political Processes: The party system in Indian politics; Local self-government in urban and rural areas; the 73rd and 74th Amendments and their implications for inclusive politics; Role and significance of women in politics. (10 lectures)</p> <p><u>Unit 6</u> Growing Social Problems in India: a) Substance abuse- impact on youth & challenges for the future b) HIV/AIDS- awareness, prevention, treatment and services c) Problems of the elderly- causes, implications and response d) Issue of child labour- magnitude, causes, effects and response e) Child abuse- effects and ways to prevent f) Trafficking of women- causes, effects and response (15 lectures) Note: 15 lectures will be allotted for project guidance Unit Number 6 will not be assessed for</p>	<p>8</p> <p>8</p> <p>8</p> <p>7</p> <p>7</p> <p>7</p>	<p>3</p>

	the Semester End Exam		
1.2	<p><u>Chemical Science – I</u></p> <p><u>Unit – I</u></p> <p><u>Periodic Table and Acid, Bases</u></p> <p>➤ Introduction and History of Periodic Table Study of Modern Periodic Table, Periodic properties –Atomic radius, ionization potential, electron affinity, electro negativity, metallic and Non-metallic characters and magnetic properties, Diagonal Relationship in S and P block element</p> <p>➤ Acids and Bases Definition of acids and bases, Arrhenius theory of acid and bases, Lowry – Bronsted theory of acid and bases, Lewis concept of acid and bases, Lux-Flood theory of acid and bases, Strength of acids and bases - trends in the strength of hydracids and oxyacid's, Concept of Soft and Hard Acid Base(SHAB)</p> <p><u>Unit – II</u></p> <p><u>Colligative Properties of Solution</u> Colligative Properties and types of properties, Lowering of vapour Pressure and Raoult's law, Elevation in boiling point, Osmosis and osmotic pressure, Problems based on all colligative properties.</p> <p><u>Unit – III</u></p> <p><u>Chemical Bonding</u> Nature of chemical bond and it's Types (Ionic, Covalent, Co-ordinate and Metallic), Types of Atomic and molecular orbitals , overlaps of atomic orbitals - s-s, p-p, s-p, p-d, d-d and their examples, Formation of sigma and pi bonds, Theories of bonding- a) valance bond theory, b) Heitler London theory and c) Pauling Slater theory , Concept of hybridization: Definition and need of hybridization, steps involved in hybridization, explanation of covalency of atoms in the moles based on hybridization, Types Of hybridization involving s, p, and d orbitals.</p>	15	3
		15	
		15	
	<ol style="list-style-type: none"> Sodium carbonate extract is to be used wherever necessary for detecting acidic radicals Determination of hardness of water from a given sample of water, by EDTA method Analysis of alkali mixture by volumetric method To standardize NaOH solution and hence find the strength of given HCl solution To standardize KMnO_4 soln. and hence find strength of the given solution Estimation of percent purity of a given sample of sodium chloride Analysis of brass Determination of Ca in presence of Mg by using 		

	<p>EDTA Estimation of Al (III) from the given aluminum salt solution by using Eriochrome Black-T indicator (Back titration method)</p> <p>8. To determine amount of acetic acid in commercial vinegar Estimation of sodium carbonate content of washing soda</p> <p>9. The Separation and Identification of Metal Ions Using Paper Chromatography Crystallization with M.P. and percent yield of purified compound Distillation with B.P. and percent yield of purified compound Sublimation with M.P. and percent yield of purified compound</p> <p>Reference books : Advanced Inorganic Chemistry, Volume-I, Nineteenth Edition - Satya Prakash, G. D. Tuli, S. K. Basu, R. D. Madan, S. Chand Publication, ISBN- 81-219-0263-0. – Page no. 59-180 657-702 Concept and model of Inorganic Chemistry, Third Edition, Douglas Mc. Doniels, Wiley India Page no 350-373 Concise Inorganic Chemistry, Fifth Edition, J. D. Lee, Wiley India Page no. 30 -91 General Chemistry, Sixth Edition, Raymond Chang, McGraw Hill</p>		
1.3	<p><u>Physical Science - I</u> <u>Unit-1</u> <u>Optics and Interference</u></p> <p>➤ Optics Reflection and Refraction, Total internal reflection, Lens Combination, Equivalent focal length of thin lenses, Magnification: lateral, longitudinal and angular.</p> <p>➤ Interference Concept and conditions, Thin film interference, Newton's Rings, Interference due to wedge shaped film, Applications : Thickness of thin film coating, Anti- reflecting coating, Interference filters.</p> <p><u>Unit -2</u> <u>Polarization and Diffraction</u></p> <p>➤ Polarization Introduction and types of Polarization, Brewster's Law, Law of Malus, Production of polarized light: Linear, Circular, Elliptical, Polarizer and Analyzer.</p> <p>➤ Diffraction Introduction, Types of diffraction : Idea about Fresnel and Fraunhofer, Difference between interference and diffraction, Diffraction due to plane transmission gratings, Resolving Power : Raleigh's criteria, Resolving power of Microscope.</p> <p><u>Unit-3</u> <u>Lasers and Fiber optics</u></p> <p>➤ Lasers Interaction of light with matter and quantum processes, Pumping process and population inversion, Spontaneous and stimulated emission, Types of laser : Solid state, Gas and semiconductor laser, Laser beam characteristics, Applications of laser : Holography, Medical, Fiber optics, Structure of optical fibre</p> <p>➤ Physical Science Practical 1. Standard operation procedure for Vernier caliper, micrometer screw and travelling microscope</p>	15	3
		15	
		15	

	<ol style="list-style-type: none"> 2. Determine the combined focal length of given lens system, 3. Determine the angle of prism using spectrometer, Determine the refractive index of material of prism using spectrometer 4. Determine the magnification of given microscopes, Determine the resolving power of microscope 5. Determine the radius of capillary using travelling microscope 6. Determine the radius of curvature of plano convex lens by Newton's Rings. 7. Determine the thickness of thin foil using air wedge, Study I V characteristics of Solar cell, Measure the divergence of given laser 8. Determine the wavelength of light using plane transmission gratings, Determine the numerical aperture of optical fibre. <p>Reference Books - A text book of Optics, Multicoloured Revised Edition 2014, Subramanyam, Brij Lal, Avadhanulu, S. Chand and Co. Pvt. Ltd, ISBN 81-219-2611-4, Engineering Physics Seventh Enlarged, Revised Edition 2004, M.N. Avadhanulu and P.G. Kshirsagar, S. Chand and Company Ltd. ISBN 81-219-0817-5, Optics - Ajoy Ghatak (3rd Ed) Mc. Graw Hill Co., Modern Physics Concept and Applications - Sanjeev Puri, Narosa Publication., Principles of Optics - B. K. Mathur and T. P. Pandya (3rd Ed.) 1981, McGraw Hill International, Fundamentals of Optics - Khanna and Gulati (1994), S. Chand, Optics - C. L. Arora, S. Cand and Co. Ltd (2001), Fundamentals of Physics-Resnik, Halliday and Walker, John Wiley Publication, Fundamentals of Optics - Jenkins and White. (4th Ed) McGraw Hill International, Optics - Ajoy Ghatak (2nd Ed.) Tata McGraw Hill, Electronic Communication System and Device - Kennedy. (4th Ed) Tata McGraw Hill, Fibre Optics - Kaiser, McGraw Hill.</p>		
1.4	<p><u>Biological Science - I</u> <u>Unit - 1</u></p> <ol style="list-style-type: none"> 1. Introduction to body parts and systems 2. Bones of upper limb (Only nomenclature and major parts) 3. Bones of lower limb (Only nomenclature and major parts) 4. Bones of pelvis (Only nomenclature and major parts) 5. Bones of skull (Only nomenclature and major parts) 6. Bones of vertebral column (Only nomenclature and major parts) 7. Bones of thorax (Only nomenclature and major parts) 8. Dental Anatomy 9. Joints and classification (Only nomenclature) <p><u>Unit 2</u></p> <ol style="list-style-type: none"> 1. Anatomy of respiratory System (Only Organ nomenclature) 2. Anatomy of cardiovascular system (Only Organ nomenclature, important arteries and veins and their branches / tributaries) 3. Anatomy of Abdominal Organs, GI system (Only nomenclature) 4. Anatomy of Pelvic Organs (Only nomenclature) 5. Anatomy of Nervous System (Only nomenclature) 6. Anatomy of Endocrine glands (only nomenclature, site) 7. Anatomy of Male and Female reproductive systems (overview) 	<p style="text-align: center;">15</p> <p style="text-align: center;">15</p> <p style="text-align: center;">15</p>	<p style="text-align: center;">3</p>

	<p><u>Unit 3</u></p> <ol style="list-style-type: none"> 1. Important Surface Landmarks – Upper Limb 2. Important Surface Landmarks – Lower Limb 3. Important Surface Landmarks - Head 4. Important Surface Landmarks – Thorax and abdomen 5. Important Surface Landmarks - Joints 6. Important Surface Landmarks – Vertebral column 7. Introduction to concepts of cross sectional anatomy 8. Meanings of axial, coronal, sagittal and oblique planes 		
<p>1.5</p>	<p>Mathematical Science – I <u>Unit – 1</u> Sequences and series: Sequences, Limit of a sequence, Convergence, Divergence and Oscillation of a sequence, Infinite series, Necessary condition for Convergence, Standard Infinite Series: Geometric Series and Harmonic series, Tests for Convergence and Divergence, Comparison Test: Only for Series with Positive Terms, Cauchy’s Integral Test, D’Alembert’s Ratio Test, Cauchy’s nth Root Test, Raabe’s Test (Higher Ratio Test), Logarithmic Test, De Morgan’s and Bertrand’s Test, Alternating Series Leibnitz’s Theorem, Absolute Convergence and Conditional Convergence, Power Series . Mean Value Theorems: Rolle’s Theorem, Lagrange’s Mean Value Theorem, Cauchy’s Mean Value Theorem, Generalized Mean Value Theorem.</p> <p><u>Unit-2</u> Partial Differentiation: Functions of Several Variables: Limit and continuity, Partial Differentiation, Variable Treated as Constant, Total Derivative, Partial Differentiation of Composite Functions: Change of Variables, Differentiation of an Implicit Function, Euler’s Theorem, Jacobian, Functional Dependence. Maxima and Minima: Taylor’s Theorem for Functions of Two Variables, Maxima and Minima of Functions of Two Variables: with and without Constraints, Lagrange’s Method of Undetermined Multipliers. Curve Tracing: Curves in Cartesian Form, Polar Curves</p> <p><u>Unit-3</u> Application of Integration: Length of Plane Curve: Rectification, Volume of solids of Revolution, Area of the Surface of a Solid of Revolution. Multiple Integrals: Introduction, Double Integral, Evaluation of a double Integral, Application of double Integral, Change of Order of Integration: Double Integral, General Change of Variable in double Integral, Change Of Variable: Cartesian to Polar Coordinates, Triple Integrals, General Change of Variable in Triple Integral</p> <p>Reference Books</p> <ol style="list-style-type: none"> 1. E. Kreyszig, Advanced Engineering Mathematics, Wiley India (2008) 2. B. V. Ramana, Higher Engineering Mathematics, Tata McGraw Hill Publishing Company Limited (2007) 	<p>15</p> <p>15</p> <p>15</p>	<p>3</p>

	<p>3. R. K. Jain, and S.R.K. Iyengar, Advanced Engineering Mathematics, Narosa Publishing House (2007)</p> <p>4. C.R. Wylie and L. C. Barrett, Advanced Engineering Mathematics, Tata McGraw-Hill (2004)</p>		
1.6	<p>Computer Science I</p> <p>Unit-1</p> <p>Number System and Codes: Decimal, Binary, Hexadecimal, Octal, BCD, conversion of one code to another, Complements (one's and two's), Signed and Unsigned numbers, Addition and Subtraction, Multiplication Gray and Hamming Codes.</p> <p>Logic Gates and Boolean Algebra: Truth Tables, OR, AND, NOT, XOR, XNOR, Universal (NOR and NAND) Gates, Boolean Theorems, DeMorgan's Theorems, Principle of duality.</p> <p>Digital Logic families: Fan-in, Fan out, Noise Margin, Power Dissipation, Figure of merit, Current and Voltage parameters, RTL, DTL, TTL, ECL, HTL, MOS, CMOS.</p> <p>Unit-2</p> <p>Combinational Logic Analysis and Design: Standard representation of logic functions (SOP and POS), Karnaugh map minimization, Quine McCluskey minimization. Multiplexers (2:1, 4:1) and Demultiplexers (1:2,4:1), Implementing logic functions with multiplexer, Adder (half and full) and subtractor, Encoder (8 to 3) and Decoder (3 to 8).</p> <p>Unit-3</p> <p>Sequential logic design: Latch, Flip flop (FF), S-R FF, J-K FF, T and D type FFs, Clocked FFs, Registers, Counters (ripple, synchronous and asynchronous, ring, modulo-N), State Table, State Diagrams and Sequential Machines.</p> <p>A/D and D/A Converters: Successive Approximation ADC, R/2R Ladder DAC.</p> <p>Memories: General Memory Operation, ROM, RAM (Static and Dynamic), PROM, EPROM, EEPROM, EAPROM.</p> <p>Reference Books:</p> <ol style="list-style-type: none"> 1. R.L. Tokheim, Digital Principles, Schaum's Outline Series, Tata McGraw-Hill (1994) 2. Donald P. Leach, Albert Paul Malvino, Digital Principles and Applications, Tata McGraw Hill (1995) 3. M. Morris Mano, Michael D. Ciletti, Digital Design, Pearson Education Asia, (2007) 4. Thomas L. Floyd , Digital Fundamentals, Pearson Education Asia (1994) 5. S.P. Bali , Solved Problems in Digital Electronics, Sigma Series, Tata McGraw-Hill, (2005) 6. W. H. Gothmann, Digital Electronics: An Introduction To Theory And Practice, Prentice Hall of India (2000) 7. R.P. Jain , Modern Digital Electronics, Tata McGraw-Hill (2003) <p>Computer Science Practical -</p> <ol style="list-style-type: none"> 1. To verify and design AND, OR, NOT and XOR gates using NAND gates. 2. Design a Full adder and a full subtractor circuit. 3. Design a 4x1 Multiplexer/ 3 to 8 decoder circuit using logic gates. 4. Implement a function (4 variable) with logic gates , MUX , Decoder 	<p>15</p> <p>15</p> <p>15</p>	

	<p>ICs</p> <ol style="list-style-type: none"> 5. Design a 4 bit parallel adder/subtractor circuit using 4 bit adder circuit IC 6. Design a seven-segment Display driver. 7. Using elementary gates build circuits for RS, Clocked RS, D, and JK Flip-Flop). 8. Design a Modulo N Asynchronous and Synchronous Counter using D/T/ JK Flip-Flop ICs. 9. Design a shift register using D/T/ JK Flip-Flops to study Serial and parallel shifting of data. 10. To design a digital to analog converter of given specifications. 		
<p>1.7</p>	<p>Analog Devices And Circuits</p> <p><u>Unit-1</u> Passive Components, accessories and tools</p> <p>Resistor, capacitor, inductors, AF transformers, IF transformers, switches, connectors, relays, solenoids, visual identification and color codes, device marking schemes and interpretation of information printed on the body of devices</p> <p>Motors (DC), contactor, circuit breakers, Fuses, MCB, ELCB</p> <p>Connectors and jacks in PC, Cell phone, still camera, video Camera, Car audio/video system, Home audio/video system</p> <p>Electrochemical cells – Chargeable, non-rechargeable, AA, AAA, Button, Cellphone battery, Typical voltages, Amp-Hour rating, precautions during use and disposal Tools: Screw-drivers, Allen key, Automatic centre punch, files, cutters, pliers, wire- strippers, hacksaw, soft tools(chemicals for electronics)</p> <p><u>Unit 2</u> : Semiconductor Devices</p> <p>semiconductor device numbering, data sheets, absolute maximum rating, reading of data sheets, packages and lead information, causes and indications of failure Displays - LEDs, LCDs, 7-segment, dot matrix, bar graph, LEDs for lighting</p> <p><u>Unit-3</u></p> <p>Drawings: Circuit symbols, standards, circuit diagram, front and rear panel</p> <p>Electrical wiring and Equipment enclosures/cabinets : Types of Wires, Gauges, Selection of wires, Types of cables, UTP, STP, Armoured, flat ribbon type etc with examples of common applications e.g. cables in a PC, safe voltage and current ranges, Colour conventions, Wire harnessing. Typical Simple Household Wiring, Wiring of tube light, switchboard wiring, stair case wiring, fan regulator and fan wiring, Power cable wiring, grounding and shielding, Earthing – necessity and methods. Electric shock and precautions. Enclosure Types: Cabinet racks (incl. NEMA 12) ,Server racks, Co-location racks, Open racks (Large open racks, table-top racks, swing-frame, relay racks), Wall mount cabinets Rack mount enclosures, Card racks, Portable cabinets, Chassis, Small metal enclosures, Cast metal enclosures, Plastic boxes, NEMA 4x enclosures</p>	<p>15</p> <p>15</p> <p>15</p>	<p>3</p>

	Analog Devices And Circuits: Recommended Books: 1. Student Reference Manual for Electronic Instrumentation Laboratories by Stanley Wolf, and Richard F.M. Smith, Prentice Hall of India Pvt. Ltd. New Delhi 2. Electronics Shop Practices, Equipment and Materials By Clyde N. Herrick Prentice Hall Inc 3. Electronic Instruments and Systems: Principles, Maintenance and Troubleshooting by R. G. Gupta Tata McGraw Hill Edition 2001 4. Modern Electronic Equipment: Troubleshooting, Repair and Maintenance by Khandpur, TMH 5. Electronic Instrumentation and Measurement Techniques by WD Cooper, AD Helfrick, Prentice Hall of India Pvt. Ltd. New Delhi		
1.8	Physical Sc. And Mathematical Sc. Practical		3
1.9	Biological Sc and Chemical Sc Practical		3
1.10	Computer Sc. And Analog Devices And Circuits Practical		3

Semester -II

PAPER NO.	SUBJECT	Total hours	Total Credits
2.11	Foundation Course -II <u>Unit 1</u> Globalisation and Indian Society: Understanding the concepts of liberalization, privatization and globalization; Growth of information technology and communication and its impact manifested in everyday life; Impact of globalization on industry: changes in employment and increasing migration; Changes in agrarian sector due to globalization; rise in corporate farming and increase in farmers' suicides. (7 lectures) <u>Unit 2</u> Human Rights Concept of Human Rights; origin and evolution of the concept; The Universal Declaration of Human Rights; Human Rights constituents with special reference to Fundamental Rights stated in the Constitution; (10lectures) <u>Unit 3</u> Ecology Importance of Environment Studies in the current	8 8 8	3

	<p>developmental context; Understanding concepts of Environment, Ecology and their interconnectedness; Environment as natural capital and connection to quality of human life; Environmental Degradation- causes and impact on human life; Sustainable development- concept and components; poverty and environment (10 lectures)</p> <p>Unit 4</p> <p>Understanding Stress and Conflict: Causes of stress and conflict in individuals and society; Agents of socialization and the role played by them in developing the individual; Significance of values, ethics and prejudices in developing the individual; Stereotyping and prejudice as significant factors in causing conflicts in society. Aggression and violence as the public expression of conflict; (10 lectures)</p> <p>Unit 5</p> <p>Managing Stress and Conflict in Contemporary Society: Types of conflicts and use of coping mechanisms for managing individual stress; Maslow's theory of self-actualisation; Different methods of responding to conflicts in society; Conflict-resolution and efforts towards building peace and harmony in society. (8 lectures)</p> <p>Unit 6</p> <p>Contemporary Societal Challenges: a) Increasing urbanization, problems of housing, health and sanitation; b) Changing lifestyles and impact on culture in a globalised world. c) Farmers' suicides and agrarian distress. d) Debate regarding Genetically Modified Crops. e) Development projects and Human Rights violations. f) Increasing crime/suicides among youth. (15 lectures)</p> <p>Note: 15 lectures will be allotted for project guidance Unit Number 6 will not be assessed for the Semester End Exam</p>	7 7 7	
2.12	<p>Chemical Science – II</p> <p>Unit -1 Thermodynamics</p> <ul style="list-style-type: none"> ➤ Definition of Thermodynamic terms (system, Surrounding etc.) ➤ Types of system ,intensive and extensive properties ,state and path functions and their differentials ➤ Thermodynamic process, concept of heat and work. ➤ First law of Thermodynamics, Statement, Definition of internal energy and enthalpy, heat capacity at constant volume and pressure and their relationship. ➤ Joules law, Joule-Thomson experiment and calculation of 	15	3

	<p>coefficient and inversion temperature.</p> <ul style="list-style-type: none"> ➤ Calculation of W, q, For expansion of an ideal gases under thermal and adiabatic conditions for reversible process. ➤ Second law of thermodynamics, need for the law, different Statement of the law. ➤ Carnot cycle and it's efficiency <p>Unit -2</p> <p>Kinetics of Homogeneous Reactions</p> <ul style="list-style-type: none"> ➤ Introduction, concept of molecularity, order and rate law. ➤ First order reactions and its characteristics ➤ Second order reactions (with equal and unequal initial concentrations) and its characteristics ➤ Third order reactions (with equal initial concentrations) and its characteristics Pseudo molecular reactions ➤ Zero order reaction ➤ Effect of temperature on rate of reaction ➤ The energy of activation ➤ Theories of reaction rate <p>Unit-3</p> <p>Electrochemistry</p> <ul style="list-style-type: none"> ➤ Redox Reaction, Oxidation and reduction Potential. ➤ Half cell ,cell potential ,Cell constant, specific conductance and molar conductance ➤ Variation of specific and equivalent conductance with dilution for strong and weak electrolytes ➤ Kohlrausch's law of independent migration of ions, ion conductance and ionic mobility <p>Chemical Science Practical</p> <ol style="list-style-type: none"> 1. To determine relative viscosity of given organic liquids by viscometer (Four liquids) 2. To determine critical solution temperature of phenol water system 3. To determine the rate constant (or to study kinetics) of acidcatalysed ester hydrolysis 4. To determine the rate constant of base catalyzed ester hydrolysis, Partition coefficient of iodine between water and carbon Tetrachloride 5. To compare the relative strength of HCl and H₂SO₄ by studying the kinetics of Inversion of cane sugar using Polarimeter 6. To determine the molecular weight of a high polymer by using solutions of different concentrations 7. To study the effect of addition of salt on critical solution temperature of phenol water system 8. To determine the transport number of cation by moving boundary Method 9. To prepare standard 0.2 M Na₂HPO₄ and 0.1 M Citric acid solution, hence prepare four different buffer solutions using them. 	<p>15</p> <p>15</p>	
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	<p>10. Determine the Pka value of these and unknown solutions by Potentiometry.</p> <p>11. To determine Pka value of given monobasic acid by Potentiometric titration</p> <p>12. To determine the formal redox potential of $\text{Fe}^{2+}/\text{Fe}^{3+}$ system Potentiometrically.</p> <p>13. To determine the amount of Cl^- and Br^- from the given halidemixture by titrating with silver nitrate solution by Potentiometry</p> <p>14. To determine Pka value of given weak acid by pH-metric titration with strong base</p> <p>15. To determine the dissociation constant of oxalic acid by pH-metric titration with strong base</p> <p>16. To determine pH of various mixtures of sodium acetate and acetic acid in aqueous solution and hence to find the dissociation of acetic acid by pH-metry.</p> <p>17. To determine the cell constant of the given cell using 0.01 M KCl solution and hence determine dissociation constant of a given monobasic weak acid by Conductometry.</p> <p>18. To estimate the amount of lead present in given solution of lead nitrate by Conductometric titration with sodium sulphate.</p> <p>Reference books : Analytical Chemistry, Sixth Edition , G. D. Christian, Wiley Publication Physical Chemistry, Fifth Edition, W.J. Moore, Pearson Principles of Physical Chemistry, Forty Fifth Edition, Puri, Sharma, Pathania, S. Chand Publication Principles of Physical Chemistry, Fourth Edition, S. H. Marron and C. F. Pruton, Macmillan New York</p>		
2.13	<p><u>Physical Science - II</u></p> <p><u>Unit - 1</u></p> <p>Nuclear Physics</p> <ul style="list-style-type: none"> ➤ Isotopes ➤ Nuclear Forces ➤ Atomic Mass Unit, Binding Energy, Mass Defect ➤ Nuclear reactions (Fission and Fusion) ➤ Nuclear reactors ➤ Radioactivity, Half-life, Mean life ➤ Successive radioactive transformation ABC type, radioactive equilibrium (transient and secular) ➤ Carbon dating <p><u>Unit - 2</u></p> <p>Thermodynamics:</p> <ul style="list-style-type: none"> ➤ Heat and Temperature ➤ Zeroth law of thermodynamics: thermal equilibrium, thermometry and temperature scales. ➤ First law of thermodynamics, Thermodynamic systems and processes, Internal energy and heat capacity, adiabatic processes. ➤ Second law of thermodynamics, Reversible and irreversible processes. 	15	3

	<p><u>Unit - 3</u> Mechanics, Fluid dynamics and Ultrasonic ➤ Mechanics Newton’s laws of motion, Important points applying for Newton’s law, Conservative and non-conservative forces, Pseudo forces, Speed and velocity, Acceleration: equation of uniformly accelerated motion, speed time graph, equation of motion for freely falling bodies, distance covered by the body in n^{th} second , Collision, Coefficient of restitution.</p> <p>Physical Science Practical Y by bending, Determination of coefficient of viscosity by Poiseulli’s method, Demonstration of terminal velocity and coefficient of viscosity by falling sphere, Ultrasonic interferometer, Sound intensity measurement</p> <p>Reference books : Engineering Physics Seventh Enlarged Revised Edition 2004 M.N. Avadhanulu and P.G. Kshirsagar, S. Chand and Company Ltd. ISBN 81-219-0817-5 Engineering Physics R.K. Gaur and S.L. Gupta, Dhanpat Rai Publication Advanced Crime Scene Photography Christopher D. Duncan, 2010, CRC Press ISBN 978-1-4200-8789-5 Crime Scene Photography, 2010, Elsevier, Edward M. Robinson, ISBN 978-0-12-375728-9 Perspective of modern Physics by Arthur Beiser Atomic and nuclear Physics by Gupta and Ghosh, 2nd Edition Introduction to Atomic and Nuclear Physics by H. Semat and Albrought Modern Physics by H.E. White New York, NY : McGraw-Hill, 1934</p>	15	
2.14	<p>Biological Science-II</p> <p><u>Unit 1</u></p> <ol style="list-style-type: none"> 1. Mechanism of respiration, Vital Capacity, Structure of Blood vessels, Cardiac cycle, cardiac output, Blood pressure, factors affecting it. 2. Autonomic nervous system- sympathetic and parasympathetic. 3. Digestion & Absorption of proteins, fats and carbohydrates <p><u>Unit 2</u></p> <ol style="list-style-type: none"> 1. Mechanism of urine formation, formation of erythropoietin and some common kidney diseases 2. Maintenance of acid base balance and electrolyte balance, Normal body temperature and mechanism of its maintenance. 3. Development of bone Rickets, osteomalasia and osteoporosis, 4. Muscle-Definition & types of muscle. <p><u>Unit 3</u></p> <ol style="list-style-type: none"> 1. Physiology of reproduction, menstruation, pregnancy and lactation. 2. Syndromes resulting from hypo and hyper activity of thyroid, parathyroid, adrenal, pituitary, pancreas 	15 15	3

	<p>Reference Books :</p> <ol style="list-style-type: none"> 1. C.C. Chatterjee (1992) Human Physiology (Vol. I, IV), 11th Edition, Medical Allied Agencies Calcutta 2. Ross & Wilson (1998) Anatomy & Physiology in health and illness, 6th Edition, ELBS, Churchill Livingstone, Medical Division of Longman group (FE) Ltd. 3. Devidson (1991) Principles & practice of medicine, 16th Edition, ELBS, Churchill Livingstone, Medical Division of Longman group (FE) Ltd. 4. Evelyn Pearce (1993) Anatomy & Physiology for nurses, 16th Edition, Oxford University Press Bombay 5. G.D. Tortora, Anatomy and Physiology Laboratory manual, Macmillan Publication 		
2.15	<p>Mathematical Science – II</p> <p><u>Unit-1</u> Vector space and linear transformation: vector spaces, subspaces, bases and dimensions, linear transformations, linear operator equations. matrices: introduction to matrices, System of Linear Algebraic Equations, Gaussian Elimination Method, Gauss- Seidel Method, LU decomposition, Solution of Linear System of LU decomposition, LU decomposition from Gaussian Elimination, LU decomposition by Gaussian Elimination, Solution to Tridiagonal Systems, Crout Reduction for Tridiagonal Linear Systems</p> <p><u>Unit-2</u> Eigen Values and Eigen Vectors: Linear Transformation, Eigen Values and Eigen Vectors, Properties of Eigen Values and Eigen Vectors, Cayley-Hamilton Theorem, Diagonalization. Powers of a Matrix. Real and Complex Matrices: Real Matrices: Symmetric , Skew Symmetric , Orthogonal Quadratic Form, Canonical Form: or sum of the squares form, Transformation (reduction) of Quadratic Form to Canonical Form, Complex Matrices: Hermitian, Skew Hermitian, Unitary Matrices, Sylvester’s Law of Inertia.</p> <p><u>Unit-3</u> Eigen Values and Eigen Vectors: Linear Transformation, Eigen Values and Eigen Vectors, Properties of Eigen Values and Eigen Vectors, Cayley-Hamilton Theorem, Diagonalization. Powers of a Matrix. Real and Complex Matrices: Real Matrices: Symmetric , Skew Symmetric , Orthogonal Quadratic Form, Canonical Form: or sum of the squares form, Transformation (reduction) of Quadratic Form to Canonical Form, Complex Matrices: Hermitian, Skew Hermitian, Unitary Matrices, Sylvester’s Law of Inertia.</p>	15	
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		15	3

	Microcontroller, Mc Graw Hill, (2000)		
2.17	<p><u>Sensors and transducers</u></p> <p><u>Unit - 1</u></p> <p>Sensors and Transducers Classification, Active, Passive, Mechanical, Electrical, their comparison. Selection of Transducers: Desirable characteristics of transducers.</p> <p>Principle and working of following types: Displacement transducers - Resistive (Potentiometric, Strain Gauges – Types, Gauge Factor, bridge circuits, Semi-conductor strain gauge) Capacitive (diaphragm), Inductive (LVDT-Principle and characteristics, Hall effect sensors, magneto-strictive transducers), Piezoelectric (Element and their properties, Piezo Electric coefficients. Equivalent circuit and frequency response of P.E. Transducers), light (photo-conductive, photo emissive, photo voltaic, semiconductor, LDR), Temperature (electrical and non-electrical). Pressure (force summing devices- load cell)</p> <p><u>Unit - 2</u> Basic concepts of instrumentation, generalized instrumentation systems block diagram representation, scope of instrumentation in Industrial organization.</p> <p>Measurement systems- Static (accuracy, sensitivity, linearity, precision, resolution, threshold, range, hysteresis, dead band, backlash, drift) ,impedance matching and loading, dynamic characteristics (types, fidelity, speed of response , dynamic error).</p> <p><u>Unit - 3</u> Definition of errors: systematic errors, instrumental errors, environmental errors, random errors, loading errors, random errors, source of errors in measuring instruments, Uncertainties types, propagation of uncertainties.</p> <p><u>Reference Books :</u> Measurement Systems, 4/e Doebelin McGraw Hill, New York, 1992. Electrical Measurements & Electronic Measurements by A.K. Sawhney Instrumentation- Devices and Systems By Rangan, Sarma, and Mani, Tata-McGrawHill Electronic Instrumentation by H.S Kalsi, McGrawHill Instrumentation measurements and analysis by Nakra & Choudhary Measurement & Instrumentation- DVS Murthy</p>	15	3
2.18	Physical Sc. And Mathematical Sc. Practical		3

2.19	Biological Sc and Chemical Sc, Practical		3
2.20	Computer Sc. And <u>Sensors and transducers</u> Practical		3

Semester -III

PAPER NO.	SUBJECT	Total hours	Total Credits
3.21	<p>Foundation Course - III</p> <p><u>Unit 1</u></p> <p>Human Rights Violations and Redressal (10 lectures) A. Types and nature of human rights violations faced by vulnerable groups, namely the Scheduled Castes, Scheduled tribes, Women, Children and Minority communities (3 lectures) B. Human Rights violations faced by People with Disabilities and by the Elderly population (1 lecture) C. Constitutional provisions and laws protecting the rights of vulnerable groups-(4 lectures) Right to Equality, Right to Freedom, Right against Exploitation. Salient features of some important Acts like The Prevention of Atrocities (Against SC/ST) Act, 1989; The Domestic Violence Act, 2005; Vishakha Guidelines for Preventing Sexual Harassment at Workplace, 1997; The Child Labour (Prohibition and Regulation) Act, 1986; The Persons With Disabilities (Equal Opportunities, Protection of Rights and Full Participation) Act, 1995; D. Redressal mechanisms at the National and State levels- (2 lectures) The National Human Rights Commission (NHRC), the SC/ST Commission, the National Commission for Women; the Minorities Commission</p> <p><u>Unit 2</u></p> <p>Dealing With Environmental Concerns (10 lectures) A. Threats to the environment arising from extinction, loss of habitat, degradation of environment, pollution, climate change (2 lectures) B. Some locally relevant case studies of environmental disasters (3 lectures) C. Concept of Disaster and general effects of Disasters on human life- physical, psychological, economic and social (2 lectures) D. Dealing with Disasters - Factors to be considered in Prevention, Mitigation (Relief and Rehabilitation) and disaster Preparedness (2 lectures) E. Human Rights issues in addressing disasters- issues related to compensation, equitable and fair distribution of relief and humanitarian approach to resettlement and rehabilitation (1 lecture)</p> <p><u>Unit 3</u></p> <p>Science and Technology I (10 lectures) A. Development of Science- the ancient cultures, the Classical era, the Middle Ages, the Renaissance, the</p>	<p>9</p> <p>9</p> <p>9</p>	<p>3</p>

	<p>Age of Reason and Enlightenment (2 lectures) B. Nature of science- its principles and characteristics; Science as empirical, practical, theoretical, validated knowledge (1 lecture) C. Science and scientific temper- significance of observation and experimentation, empirical explanation and objectivity; scientific temper as a fundamental duty of the Indian citizen (2 lectures) D. Science and Superstition- the role of science in exploding myths, blind beliefs and prejudices; role of science and scientific temper in promoting tolerance and harmony in social groups (3 lectures) E. Science in everyday life- technology, its meaning and role in development; Interrelation and distinction between science and technology (2 lectures)</p> <p><u>Unit 4</u></p> <p>Soft Skills for Effective Interpersonal Communication (8 lectures) A I) Effective Listening- importance and features II) Verbal and non-verbal communication; public-speaking and presentation skills III) Barriers to effective communication; importance of self-awareness and body language (3 lectures) B I) Formal and Informal communication- purpose and types II) Writing formal applications, Statement of Purpose (SOP) and resume III) Preparing for Group Discussions, Interviews and Presentations (3 lectures) C I) Leadership Skills and Self-improvement- characteristics of effective leadership II) Styles of leadership and team building (2 lectures)</p> <p><u>Unit 5</u></p> <p>Understanding Issues of Right to Health and Education(7 lectures) A I) Concept and Determinants of Health- holistic health including physical and mental well- being; food security, adequate nutrition, safe drinking water and sanitation, healthy environment and working conditions, availability of healthcare and medical services, gender equality II) Right to Health- right to a system of health protection to all without discrimination; right to prevention, treatment and control of diseases; Access to essential medicines; III) Issues of access, affordability and availability in promoting Right to Health(4 lectures) B I) Right to Education- universalization of education and obstacles to free and compulsory education for all II) Issues of access, affordability and availability in the education sector III) Contemporary challenges in the Education sector-increasing privatisation of education, decreasing fund allocation by Government (3 lectures)</p>	9	
3.22	<p>Chemical Science – III</p> <p>Biomaterials-I</p> <p><u>Unit-1</u></p> <p>Definition of biomaterials, requirements of biomaterials, classification of biomaterials, Comparison of properties of some common biomaterials.</p>	15	3

	<p>Effects of physiological fluid on the properties of biomaterials. Biological responses (extra and intra vascular system). Surface properties of materials, physical properties of materials, mechanical properties.</p> <p><u>Unit-2</u></p> <p>Metallic implant materials , Stainless steel, Co, based alloys, Ti and Ti, based alloys. Importance of stress, corrosion cracking. Host tissue reaction with biometal, corrosion behavior and the importance of passive films for tissue adhesion. Hard tissue replacement implant: Orthopedic implants, Dental implants. Soft tissue replacement implants: Percutaneous and skin implants, Vascular implants, Heart valve implants, Tailor made composite in medium.</p> <p><u>Unit-3</u></p> <p>Polymeric implant materials , Polyolefins, polyamides, acrylic polymers, fluorocarbon polymers, silicon rubbers, acetals. (Classification according to thermosets, thermoplastics and elastomers). Viscoelastic behavior: creep, recovery, stress relaxation, strain rate sensitivity.</p> <p>Text Books</p> <ol style="list-style-type: none"> 1. Park, J. B. and Lakes, R. S., Biomaterials, Third edition, Springer (2007) <p>Reference Books</p> <ol style="list-style-type: none"> 1. J B Park, Biomaterials , Science and Engineering, Plenum Press , 1984. 2. Sujata V. Bhat, Biomaterials, Narosa Publishing House, 2002. 3. C.P.Sharma & M.Szycher, Blood compatible materials and devices, Technomic Publishing Co. Ltd., 1991. 4. Piskin and A S Hoffmann, Polymeric Biomaterials (Eds), Martinus Nijhoff Publishers. (Dordrecht. 1986) 	<p>15</p> <p>15</p>	
<p>3.23</p>	<p>Physical Science - III</p> <p><u>Unit-1</u></p> <p>Medical Imaging: Physical aspects of medical imaging, LASER beam in biology & medicine, Fundamentals of laser physics, Medical lasers(Carbon Dioxide Laser, Nd:YAG Laser,),Applications of Lasers in therapy and diagnosis, photo-thermal effects, photochemical effects, Principle, instrumental set up, procedure and medical utility of X-ray imaging, Xero-radiography, Fluoroscopy, Computer Tomography Scan, Magnetic Resonance Imaging, Ultrasound in medicine-Physical properties of ultrasound (the velocity, the frequency, intensity) Ultrasound interactions with the tissues (reflection, diffraction, refraction, absorption, scattering,), Ultrasound application in medicine. safety Aspects of diagnostic and therapeutic ultrasound</p> <p><u>Unit-2</u></p>	<p>15</p>	<p>3</p>

	<p>Nuclear Medicine : In-vitro & in-vivo imaging using radioisotopes, Blood volume determinations by isotopic method, Radioiodine diagnosis & therapy in thyroid disorders, Principle, method and applications of Radioimmunoassay, organ scans-thyroid, liver, brain, bone, renal imaging, cardiac imaging, PET scan, nuclear medicine for therapy, radiopharmaceuticals-concept, production and use</p> <p>Unit-3 Basic Electrophysiology: Nature of bioelectric signal, Fundamental concepts in bioelectricity & bioelectronics, principles & utility of patch-clamp, ELECTROCARDIOGRAPHY (ECG) Fundamental principles of electrocardiography, Cardiac electrical field generation during activation , Electrocardiograph lead systems,The normal P wave, Atrial repolarisation ,Atrio-ventricular node conduction and the PR segment,Ventricular activation and the QRS complex ,Ventricular recovery and ST-T wave U wave ,Normal variants ,Rate and rhythm Principle, instrument_design and medical utility : EEG ,EMG ,ERG,EOG ,Visual evoked potentials, biological impedance and its significance.</p> <p>References</p> <ol style="list-style-type: none"> 1. Beiser A.: Physics, Addison-Wesley, Massachusetts 1991, Chapter 27, pp. 803-807 2. Katzir A.: Lasers and Optical Fibers in Medicine, Academic Press, Inc. 1993 3. Medical Instrumentation applications and design by John G. Webster. 4. Biomedical Instrumentation Technology and applications by Khandpur. Mc Graw –Hill. 5. Biomedical Instrumentation systems by Shakti Chatterjee. 6. R.S.Khandpur, 'Hand Book of Bio-Medical instrumentation', McGraw Hill Publishing Co Ltd. 2003. 7. Leslie Cromwell, Fred J.Weibell, Erich A.Pfeiffer, Biomedical Instrumentation and Measurements, Pearson Education 8. M.Arumugam, 'Bio-Medical Instrumentation', Anuradha Agencies, 	<p>15</p> <p>15</p>	
<p>3.24</p>	<p>Biological science-III Unit 1</p> <ol style="list-style-type: none"> 1. Introduction to body parts and systems 2. Development of Bone tissue (osteogenesis), Types of bones and joints, Development of bone. Rickets, osteomalasia and osteoporosis 3. Anatomy of respiratory System (Only Organ nomenclature) <p>Unit 2</p> <ol style="list-style-type: none"> 1. Anatomy of cardiovascular system (Only Organ nomenclature, important arteries and veins and their branches / tributaries) 2. Anatomy of Abdominal Organs, GI system (Only nomenclature) 3. Anatomy of Pelvic Organs (Only nomenclature) 	<p>15</p> <p>15</p> <p>15</p>	<p>3</p>

	<p>Unit 3</p> <ol style="list-style-type: none"> 1. Anatomy of Nervous System (Only nomenclature) 2. Anatomy of Endocrine glands (only nomenclature, site) 3. Anatomy of Male and Female reproductive systems (overview) 		
3.25	<p>Mathematical Science – III</p> <p>Unit – 1</p> <p>Partial Differential equations: Formation of Partial Differential Equation, Partial Differential Equation of First Order, Linear Equations of First Order, Non-linear Partial Differential Equations of First Order, Method Of Separation of Variables, Classification of Partial Differential Equations of Second Order. Convolution theorem, Impulse Function and Unit Step function, solutions to ordinary differential equations. Initial and Final value theorem.</p> <p>Unit-2</p> <p>Laplace Transform: Laplace Transform and its properties, Convolution theorem, Impulse Function and Unit Step function, solutions to ordinary differential equations. Initial and Final value theorem, system of differential equations, Laplace transforms. Modeling a Vibrating string and the Wave Equation, Separation of variables, Inverse Laplace transforms and their properties.</p> <p>Unit-3</p> <p>Fourier series and Transforms: Functions of any period, even and odd Functions, half range expansions, Forced Oscillations, Complex Fourier Series Fourier Integral, Fourier Sine and Cosine Transforms. , Fourier Transforms, Discrete and Fast Fourier Transforms. Fourier integrals, Modeling a Vibrating string and the Wave Equation, Separation of Variables and Use of Fourier series.</p> <p>Reference Books:</p> <ol style="list-style-type: none"> 1. E. Kreyszig, Advanced Engineering Mathematics, Wiley India (2008), 8th Edition 2. B. V. Ramana, Higher Engineering Mathematics, Tata McGraw Hill Publishing Company Limited (2007), 6th reprint 3. Michel D Greenberg; Advanced Engineering Mathematics, Pearson International 4. R. K. Jain, and S.R.K. Iyengar, Advanced Engineering Mathematics, Narosa Publishing House (2007), 3rd edition 5. C .R. Wylie and L. C. Barrett, Advanced Engineering Mathematics, Tata McGraw-Hill (2004) 6. A.S.Willsky, Oppenheim, Signals and System, Prentice Hall, 2nd edition 7. B.S. Grewal; Higher Engineering Mathematics, Khanna Publishers 	15	15
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<p>3.26</p>	<p>Computer Science – III Concepts of Networking and OS Unit-I Introduction to Networking</p> <ul style="list-style-type: none"> ➤ Introduction : Data Communication, Networks, Internet, Intranet, Protocols, OSI and TCP/IP Models, Addressing ➤ Multiplexing : FDM, WDM, Synchronous TDM (Time Slots and Frames, Interleaving, Data Rate Management) ➤ Connecting Devices : Repeaters, Hubs, Bridges, Spanning Tree algorithm, Two and Three layer Switches, Routers, Gateways, Backbone networks, Concept of VLAN ➤ Network Layer : Logical addressing, IPv4 Addresses, Classful and Classless addresses, NAT, IPv6 Addressing Protocols (ARP, RARP, DHCP, FTP, HTTP, TCP, UDP) <p>Unit-II Operating System and Windows</p> <ul style="list-style-type: none"> ➤ Introduction to Operating system: Introduction, Types of O.S. ➤ Windows System : History, Features ➤ Understanding File System : Understanding Boot Sequence, Understanding Disk Drives Understanding Windows registry Understanding Windows start up tasks. ➤ Windows Commands. <p>Unit-3 Linux</p> <ul style="list-style-type: none"> ➤ Linux System : History, Design Principles, File System. ➤ Linux Basics: Looking into the Linux Kernel, GNU Utilities, ➤ Desktop Environments, the Linux Console, the Unix/Linux architecture, Features of Unix/Linux. ➤ Basic Bash Shell Commands : Starting the shell, Shell Prompt, File System Navigation, File and Directory Listing, File Handling, Directory Handling, Viewing File Contents ➤ More Bash Shell Commands : Monitoring programs, Monitoring Disk Space ➤ Working with Data Files: Sorting, Searching, Compressing, Archiving ➤ Understanding Linux File permission : Linux Security, Using Linux Groups, Decoding File Permissions, Changing Security Settings, Sharing files <p>Reference Books : Data Communication and Networking, Forouzan, Tata McGraw-Hill Education Publication Operating System Concepts, Silberschatz, Galvin, Gagne, John Wiley and Sons Publications Guide to Computer Forensics and Investigation, Bill Nelson Unix Concepts and Applications, Sumitabha Das, TMH Publications Linux Command Line and Shell Scripting : Bible, Richard Blum, Wiley-India Publications</p>	<p>15</p> <p>15</p> <p>15</p> <p>3</p>	<p>3</p>
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	<p>Computer Science III Practical</p> <ol style="list-style-type: none"> 1. Study of Networking Devices 2. Windows – Demonstration 3. Windows – Installation 4. Windows - Basic commands 5. Windows - Network Configuration 6. Linux – Demonstration 7. Linux – Installation 8. Linux - Basic Commands 9. Linux- Advanced Commands 		
3.27	<p>Operational amplifiers</p> <p>Unit-I Basic Operational Amplifier: Concept of differential amplifiers, block diagram of an operational amplifier (IC741) Op-Amp parameters: input offset voltage, input offset current, input bias current, differential input resistance, input capacitance, offset voltage adjustment range, input voltage range, common mode rejection ratio, slew rate, supply voltage rejection ratio.</p> <p>Unit-II Op-Amp in open and closed loop configuration: Frequency response of an op-amp in open loop and closed loop configurations, Inverting, Non-inverting, summing and difference amplifier, Integrator, Differentiator, voltage to current converter, current to voltage converter. Comparators: Basic comparator, Level detector, Voltage limiters, Regenerative comparator.</p> <p>Unit-III Signal generators: Phase shift oscillator, Wien bridge oscillator, Schmitt Trigger, Square wave generator, triangle wave generator, sawtooth wave generator, Voltage controlled oscillator (IC 566), Phase locked loops (PLL) Multivibrators (IC 555): Block diagram, Astable and monostable multivibrator circuit, Voltage to frequency (V/F) and frequency and voltage (F/V) converter. Signal Conditioning circuits: Sample and hold systems, Active filters: First order low pass and high pass butterworth filter, Second order filters, Band pass filter, Band reject filter, All pass filter, Logarithmic and exponential amplifiers.</p>	15 15 15	
3.28	Physical Sc. And Mathematical Sc. Practical		3
3.29	Biological Sc and Chemical Sc, Practical		3
3.30	Computer Sc. And Operational Amplifiers Practical		3

Semester -IV

PAPER NO.	SUBJECT	Total hours	Total Credits
4.31	<p>Foundation Course –IV</p> <p><u>Unit 1</u></p> <p>Significant Rights of Citizens (10lectures) A. Rights of Consumers-right to safety, right to be informed, right to choose, right to be heard,right to seek redressal, right to consumer education; Violations of consumer rights and important provisions of the Consumer Protection Act, 1986; Other important laws to protect consumers, like- Indian Contract Act, 1872, Sale of Goods Act, 1930, The Essential Commodities Act, 1955, The Prevention of Food Adulteration Act, 1955, The Standards of Weights and Measures Act, 1976 Consumer courts and consumer movements (4 lectures) B. Right to Information- Genesis and relation with transparency and accountability; important provisions of the Right to Information Act, 2005; some success stories (3 lectures) C. Protection of Citizens'/Public Interest-Public Interest Litigation, need and procedure to file a PIL; some landmark cases. (3 lectures)</p> <p><u>Unit 2</u></p> <p>Ecology:Approaches, Ethics and Issues (9 lectures) A. Understanding approaches to ecology- Anthropocentrism, Biocentrism and Eco centricism, Ecofeminism and Deep Ecology (3 lectures) B. Environmental Ethics- Libertarian ethics, Ecologic Extension and Conservation; concept of intrinsic and extrinsic value of human and non-human life; eco spirituality. (3 lectures) C. Some significant principles and issues- 'polluter pays' principle and global and local issues of fair share of carbon space (3 lectures)</p> <p><u>Unit 3</u></p> <p>Science and Technology II (10 lectures) A. Technology and Development- the interconnectedness between growth of technology and development of societies (2 lectures) B. Some significant modern technologies, their basic features and applications:(6 lectures) Laser Technology- Light Amplification by Stimulated Emission of Radiation"; use of laser in remote sensing, GIS/GPS mapping, medical use Satellite Technology- various uses in satellite navigation systems, GPS, and inprecise climate and weather analyses Information and Communication Technology- electronic systems such as telecommunication, radio, television, video and internet aided by computer-based information systems; convergence of various technologies like satellite, computer and digital in the information revolution of today's society Biotechnology and Genetic engineeriong- applied biologyand uses in medicine, pharmaceuticals and agriculture; genetically modified plant, animal and human lifeNanotechnology- definition: the study, control and application of phenomena and materials at length scales below 100 nm; uses in</p>	8 8 8 7	3

	<p>medicine, military intelligence and consumer products C. Issues of Control, Access and Misuse of Technology (2 lectures)</p> <p><u>Unit 4</u></p> <p>Introduction to Competitive Exams (9 lectures) A. Basic information on Competitive Exams- the pattern, eligibility criteria and local centres: Exams conducted for entry into professional courses- Graduate Record Examinations (GRE), Graduate Management Admission Test (GMAT), Common Admission Test (CAT) and Scholastic Aptitude Test (SAT) Exams conducted for entry into jobs by Union Public Service Commission, Staff Selection Commission (SSC), State Public Service Commissions, Banking and Insurance sectors, and the National and State Eligibility Tests (NET/SET) for entry into teaching profession (3 lectures) [NOTE: Students will not be tested on above topics] B. Soft skills required for competitive exams- i) Information on areas tested- Quantitative Ability, Data Interpretation, Verbal Ability and Logical Reasoning, Creativity and Lateral Thinking ii) Motivation- concept, theories and types of motivation iii) Goal-setting- types of goals, SMART goals, Stephen Covey's concept of human endowment iv) Time Management- effective strategies for time management (6 lectures)</p> <p><u>Unit 5</u></p> <p>Urban-Rural Disparities in Development (7 lectures) A. Concept of 'rural', 'tribal', 'semi-urban' and 'urban'; disparity in availability of services like health, education, transport, electricity and employment (2 lectures) B. Distribution of natural resources like land, water and forests in rural and urban areas; changing land-use and impact on rural life (2 lectures) C. Increasing urbanisation and growth of megacities- issues of adequate water availability, affordable housing, transport/traffic congestion, waste management and social tension (3 lectures)</p> <p><u>Unit 6</u></p> <p>Projects/Assignments (15 lectures) Projects/Assignments should be drawn for the component on Internal Assessment from the topics in Unit 1 to Unit 5. Students should be given a list of possible topics- at least 3 from each unit at the beginning of the semester. The project/assignment can take the form of street- plays/power-point presentations/poster exhibitions and similar other modes of presentation appropriate to the topic; students can work in groups of not more than 8 per topic. Students must submit a hard/soft copy of the project/assignment before appearing for the semester end exam.</p>	7	7
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<p>4.32</p>	<p>Chemical Science – IV</p> <p>Biomaterials-II</p> <p><u>Unit-1</u></p> <p>Importance of molecular structure, hydrophilic and hydrophobic surface properties, migration of additives (processing aids), aging and environmental stress cracking. Physiochemical characteristics of biopolymers. Biodegradable polymers for medical purposes, Biopolymers in controlled release systems. Synthetic polymeric membranes and their biological applications</p> <p><u>Unit-2</u></p> <p>Definition of bioceramics. Common types of bioceramics. Importance of wear resistance and low fracture toughness. Host tissue reactions: importance of interfacial tissue reaction Mechanics of improvement of properties by incorporating different elements. Composite theory of fiber reinforcement. Polymers filled with osteogenic fillers. Host tissue reactions.</p> <p><u>Unit-3</u></p> <p>Definition of biocompatibility, blood compatibility and tissue compatibility. Toxicity tests: acute and chronic toxicity studies, sensitization, carcinogenicity, mutagenicity and special tests. In vitro testing (Mechanical testing): tensile, compression, wears, fatigue, corrosion studies and fracture toughness. In, vivo testing (animals): biological performance of implants. Standards of implant materials.</p> <p>Text Books</p> <p>1. Park, J. B. and Lakes, R. S., Biomaterials, Third edition, Springer (2007)</p> <p>Reference Books</p> <p>1. J B Park, Biomaterials , Science and Engineering, Plenum Press , 1984.</p> <p>2. Sujata V. Bhat, Biomaterials, Narosa Publishing House, 2002.</p> <p>3. C.P.Sharma & M.Szycher, Blood compatible materials and devices, Technomic Publishing Co. Ltd., 1991.</p> <p>4. Piskin and A S Hoffmann, Polymeric Biomaterials (Eds), Martinus Nijhoff Publishers. (Dordrecht. 1986)</p>	<p>15</p> <p>15</p> <p>15</p>	<p>3</p>
<p>4.33</p>	<p>Physical Science – IV</p> <p>Photonics in biomedical Instruments</p> <p><u>Unit-1</u></p> <p>Concepts of Emission, Transmission,</p>	<p>15</p>	

	<p>Modulation</p> <p><u>Unit-2</u></p> <p>Signal Processing Switching Amplification Detection, sensing</p> <p><u>Unit- 3</u></p> <p>Surgical lasers: CO2 Argon Nd: YAG, Potassium Titanyl Instruments and applications</p> <p>Recommended Books:</p> <ol style="list-style-type: none"> 1. Ajoy Ghatak -Optics - (TMH) 2. Aurthur Beiser -Concepts of Modern Physics - (Mc-Graw Hill) 3. Anuradha De. -Optical Fibre & Laser (New Age) 	<p>15</p> <p>15</p>	<p>3</p>
<p>4.34</p>	<p style="text-align: center;">Biological science-IV</p> <p><u>Unit 1</u></p> <ol style="list-style-type: none"> 1. Composition of Blood, Function of cellular components, Common blood analysis, their significance, Blood groups and clotting of blood, Erythropoiesis, Anaemias, Classification and blood picture of important dietary deficiency anaemias. 2. Blood pressure and factors affecting it, Hyper tension - types and mechanism of development 3. Structure and function of GI tract, Digestion and absorption of proteins, fats & carbohydrates. Brief outline of GI tract, disorders and the physiological changes. <p><u>Unit 2</u></p> <ol style="list-style-type: none"> 1. Mechanism of urine formation, Formation of erythropoietin and some common kidney diseases. 2. Maintenance of acid base balance and electrolyte balance. 3. Normal body temperature and mechanism of its maintenance. 4. Syndromes resulting from hypo and hyper activity of thyroid, parathyroid, adrenal, pituitary, pancreas. 5. Physiology of reproduction, menstruation, pregnancy and lactation. <p><u>Unit 3</u></p> <ol style="list-style-type: none"> 1. Mechanism of respiration, vital capacity, Brief outline of common respiratory diseases 	<p>15</p> <p>15</p> <p>15</p>	<p>3</p>

	<p>2. Development of Bone tissue (osteogenesis), Types of bones and joints, Development of bone. Rickets, osteomalasia and osteoporosis</p> <p>Recommended Books:</p> <p>6. C.C. Chatterjee (1992) Human Physiology (Vol. I, IV), 11th Edition, Medical Allied Agencies Calcutta</p> <p>7. Ross & Wilson (1998) Anatomy & Physiology in health and illness, 6th Edition, ELBS, Churchill Livingstone, Medical Division of Longman group (FE) Ltd.</p> <p>8. Devidson (1991) Principles & practice of medicine, 16th Edition, ELBS, Churchill Livingstone, Medical Division of Longman group (FE) Ltd.</p> <p>9. Evelyn Pearce (1993) Anatomy & Physiology for nurses, 16th Edition, Oxford University Press Bombay</p> <p>10. G.D. Tortora, Anatomy and Physiology Laboratory manual, Macmillan Publication</p>		
4.35	<p>Mathematical Science - IV</p> <p>Bio Statistics</p> <p>Unit-1</p> <p>Statistics, Biostatistics and Biometry, Aims of Biostatistics, Applications of Biostatistics. Data Collection, Necessity of Sampling, Types of Sampling Data Processing, Data Summarization, Classification of Data Methods of classification of Data, Differences Between Classification and Tabulation, Formation of Frequency Distribution.</p> <p>Tabular Representation of Data, Graphic Representation of Data, Line Diagram, Histogram, Frequency Polygon, Frequency Curve, Cumulative Frequency Curve or Ogive, Scatter or Dot Diagram, Bar Diagram, pie diagram, Pictogram And Cartogram.</p> <p>Unit-2</p> <p>Average, Objectives of Averages, Characteristics of an Ideal Measure of Central Tendency Types of Averages, Mean, Median, Mode, Measures of Dispersion, Range, Standard Deviation, Standard Error.</p> <p>Correlation, Types of Correlation, Measures of Simple Correlation, Regression, Simple Regression, Regression Equation</p> <p>Unit-3</p> <p>Important Terms and Concepts, Sample point, Sample space, Trial and Event; Classical Definition of Probability, Frequency Definition of Probability, Rules of Probability (Addition Rule and Multiplication Rule) Random variable and Probability Distribution, Binomial Distribution, Poisson Distribution and Normal Distribution. Test of Significance, Computation of Test of Significance, Test for the mean of a Normal Population, chi-square test, 't' test, F-test and their significance, analysis of variance (ANOVA).</p>	15	15

	<p>Reference Books:</p> <ol style="list-style-type: none"> 1. P. S. S. Surnder Rao and J. Richard (1996), An introduction to Biostatistics, Prentice Hall of India. 2. Campbell R.C. (1974), Statistics for biologist, Cambridge University Press. 3. Wardlaw, A.C (1985), Practical Statistics for Experimental biologist. 4. Bailey, (2000), Statistical Method in biology. 5. Daniel Wayle W., Biostatistics (A foundations for analysis in health sciences). 		
4.36	<p>Computer Science - IV Biomedical Image analysis Unit-1 Introduction - Driving problems in biomedical imaging Sources of imaging data acquisition and noise Elementary image processing Grenander's Pattern Theory</p> <p>Unit-2 Edge detection and active snakes - Intensity-driven methods: expectation-minimization, Markov random fields Graph cut algorithms for image segmentation Shape-driven methods: active shape/appearance models problems of correspondence Level set methods - Skeletonization and medial methods</p> <p>Unit-3 Introduction to functional Neuroimaging - Hypothesis testing and statistical mapping; permutation tests - Cortical surface segmentation and flattening - Diffusion tensor imaging</p>		
4.37	<p>Power Electronics Unit-1 Basic Power Devices and Circuits: SCR, Diacs and Triacs, Two transistor model of SCR, Resistive and RC triggering circuits. Applications of SCR: Basic series inverter circuit, Chopper circuit – Basic concept, step up and step down choppers.</p> <p>Unit-2 Types of motors and Motor Drives: Constructional features and characteristics of DC Motors, AC Motors, Induction Motors, Single and three phase Motors, Synchronous Motors, Stepper Motors, and Servo Motors. Motor driving and speed control circuits and their applications, motor starters.</p> <p>Unit-3 Generators and AC machines: AC and DC generators, comparison between generator and motor action (without constructional comparison). AC Machines: Types of transformers, Transformer</p>		

	Construction, E.M.F. equation, Transformer Losses, Condition for maximum efficiency, all day efficiency, Auto transformers. Block diagrams and description of UPS and SMPS		
4.38	Physical Sc. And Mathematical Sc. Practical		3
4.39	Biological Sc and Chemical Sc. Practical		3
4.40	Computer Sc. And Power Electronics Practical		3

Semester-V

PAPER NO.	SUBJECT	Total hours	Total Credits
5.41	<p><u>Medical Instrumentation for Vital signs</u></p> <p><u>Unit 1</u> Biopotentials Electrical activity of excitable cells -Central nervous system functional organization of peripheral nervous system -ENG, EMG, ECG, EEG Biopotential electrodes -Body surface recording electrodes -Internal electrodes -Electrode arrays, microelectrodes - Electrodes for electric stimulation of tissue -Ion selective electrodes Practical hints in the use of electrodes</p> <p><u>Unit 2</u> Recording systems Basic recording system. General considerations for bioelectric recorder amplifier. Sources of external noise in low level recording circuits. Amplifiers used with recording systems. Writing systems.</p> <p><u>Unit 3</u> Electrical safety Physiological effects of electric current. Electric power distribution system. Macroshock and microshock hazards. Prevention of accidents and grounding of equipment. Double insulation, protection by low voltage, ground fault circuit interrupter. Isolation of patient connected parts. Isolated power distribution system.</p> <p>Reference books: Medical instrumentation: Application and design by J. G. Webster John Wiley and sons 2003 Handbook of Biomedical Instrumentation by R. S. Khandpur Tata McGraw Hill Bioinstrumentation by J. G. Webster John Wiley and sons 2004</p>	<p style="text-align: center;">15</p> <p style="text-align: center;">15</p> <p style="text-align: center;">15</p>	3
5.42	<p><u>Principles of Diagnostic and Therapeutic Equipments-I</u></p> <p><u>Unit - 1</u> Ventilators: Parameters, system concepts, their classification, valve, humidifiers, nebulizers.</p>	15	

	<p>Oximeter: in vivo, invitro, pulse and ear type.</p> <p>Blood flow meter: electromagnetic types. Blood gas analyzers- acid base balance, blood ph, pCO₂, pO₂ measurement</p> <p><u>Unit - 2</u></p> <p>Biotelemetry: design, single channel, bio telemetry transmitter and receiver system, based on AM, FM modulation, pulse modulation.</p> <p>Nuclear medicine system: Radioactive emissions, rectilinear scanner, gamma camera, imaging system, ECT (emission coupled tomography), positron emission tomography, safety measures.</p> <p><u>Unit - 3</u></p> <p>Clinical Instruments: General principle, working and application of Auto analyzers, Elisa reader, Thermal Cycluser, Blood cell counter, equipments used in surgery, safety.</p> <p>Fibre Optic Endoscopy: Principles and applications, neonatal instrumentation, Incubators, anesthesia equipment.</p> <p>Reference Books Joseph J. Carr & John. M. Brown - Introduction to Biomedical Equipment technology R.S. Khandpur - Handbook of Biomedical Instrumentation, McGraw Hill. J.G. Webster - Medical instrumentation application and design, Houghton Mifflin Co., Boston USA. ohan Murali H. - Monograph on Biomedical engineering, O.U. Press 1985. Geddes L. A. & L. E. Baker - Principles of Applied Biomedical Instrumentation, Wiley, 1989. Leslie Cromwell, Fred J. Weibell and Erich A. Pfeiffer - Biomedical Instrumentations and Measurements (2e), PHI, 1991.</p>	<p>15</p> <p>15</p>	<p>3</p>
<p>5.43</p>	<p>Instrumentation of Imaging Techniques- I</p> <p><u>Unit - 1</u></p> <p>Photographic aspects of radiography and image information. Construction of radiographic film Working principle radiographic film Types of radiographic film and comparative evaluation. Intensifying screen: working principle, construction, performance parameters, types of screens, classification.</p>	<p>15</p>	<p>3</p>

	<p>Unit - 2 Film cassettes: construction and types, basic testing procedures. Film processing: Basic chemistry and principles, preparing chemical solutions, development and fixing Basic principle of dark room design and construction. Concept of safe light. Need of safe light.</p> <p>Unit - 3 Types of processing: manual and automatic, Manual processing: Layout and procedures. Automatic processing: Technology, designs and types. Film faults and related prevention methods. Replenishment. Environmental problems in dark room management. Basic quality tests of darkroom. X Ray artifacts and their detection.</p>	15	
5.44	<p>X-Ray Techniques- I Unit - 1 Electromagnetic Spectrum. Thermionic emission and its applications. Interaction of energy and matter at the atomic level. Radioactivity: Laws, terminology, concept of Half Life. Sound: Acoustics and wave motion.</p> <p>Unit - 2 Principles of X-ray Production, Components of X-Ray machine, block diagram, description of each block. Construction, principles, types, selection criteria, and connections of : main fuse box, auto transformer, high tension transformer, timer, location, purpose and function of filament control , filament heating transformer, line voltage compensator, rectifiers, X Ray generators, Power supply</p> <p>Unit - 3 Construction of X Ray Tube, rotating anode X Ray tube, production of X ray Effect of KVP and mA, tube ratings, Earthing of X Ray machine, effect of filters and beam limiting devices on radiation quality.</p>	15 15 15	3
5.45	<p>Embedded Systems In Medicine Unit -1 Definition and Classification, Embedded System Development Process, Embedded Operating systems, Types of Embedded Operating systems. Intel MCS51 Architecture, Derivatives - Special Function Registers (SFR), I/O pins, ports and circuits, Instruction set, Addressing Modes, Assembly Language Programming, Timer and Counter Programming, Serial Communication, Connection to RS 232, Interrupts Programming, External Memory interfacing.</p> <p>Unit - 2 Embedded system evolution trends. Round - Robin, robin with</p>	15	

	<p>Interrupts, function-One- Scheduling Architecture, Algorithms. Introduction to-assembler-compiler-cross compilers and Integrated Development Environment (IDE). Object Oriented Interfacing, Recursion, Debugging strategies, Simulators. Task and Task States, tasks and data, semaphores and shared Data Operating system Services-Message queues-Timer Function-Events-Memory Management, Interrupt Routines in an RTOS environment, basic design Using RTOS.</p> <p><u>Unit - 3</u></p> <p>Applications: Real-Time Embedded Software Development, Sending a Message over a Serial Link, Simulation of a Process Control System, Controlling an Appliance from the RT Linux System, Embedded Database Applications, Embedded medical applications: Ophthalmology Glaucoma screening device, Medical Imaging Acquisition User Interface, Drug delivery systems, Patient monitoring Systems.</p> <p>Reference Books:</p> <p>Steve Heath, Embedded Systems Design, Second Edition-2003, Newnes,</p> <p>David E.Simon, An Embedded Software Primer, Pearson Education Asia, First Indian Reprint 2000.</p> <p>Fundamentals of Embedded Software, where C and Assembly Meet by Daniel W. Lewis (Pearson Education).</p> <p>Design with PIC Microcontrollers by John B. Peatman (Pearson Education).</p> <p>Embedded C Programming and the Microchip PIC by Richard Barnett, Larry O’Cull and Sarah Cox (Thomson Learning).</p> <p>Microprocessors: From Assembly Language to C using PIC18Fxx2</p>	<p>15</p> <p>15</p>	<p>3</p>
<p>5.46</p>	<p><u>Fundamentals of Troubleshooting Techniques</u></p> <p><u>Unit - 1</u></p> <p>Fundamental Troubleshooting Procedures</p> <p>Inside An Electronic Equipment: Reading Drawings And Diagrams – Block Diagram, Circuit Diagram, Wiring Diagram; Dis-assembly and re-assembly of equipment, Equipment Failures and causes such as poor design, production deficiencies, careless storage and transport, inappropriate operating conditions, Nature of faults, Fault location procedure, Fault finding aids – Service and maintenance manuals and instruction manuals, Test and Measuring instruments, special tools. Troubleshooting techniques, Approaching components for tests, Grounding systems in Electronic Equipment, Temperature sensitive Intermittent problems. Corrective actions, Situations where repairs should not be attempted.</p> <p><u>Unit - 2</u></p>	<p>15</p> <p>15</p>	<p>3</p>

	<p><u>Unit – 3</u></p> <p>Writing: Importance of Writing, Written Vs Spoken Language, Formal and Informal Styles of writing, Resources for improving writing, Grammar and Usage, Vocabulary Building, SWOT analysis.</p> <p><u>Unit - 4</u></p> <p>Speaking practice: Dialogue, Telephone Etiquette, Public Speaking, Debate, informal discussions, presentations.</p> <p>Aptitude: Verbal and Numerical aptitude</p> <p>References Books - Nicholls, Anne. Mastering Public Speaking. Jaico Publishing House,2003. Aggarwal, R.S. Quantitative Aptitude. S.Chand &Co.,2004. Leigh, Andrew and Michael Maynard. The Perfect Leader. Random House Business Books,1999. Whetton .A.David and Kim S. Cameron. Developing Management Skills. Pearson Education, 2007. K.R. Lakshminarayan. Developing Soft Skills. Scitech, 2009. Sherfield M Robert. Developing Soft Skills Pearson Education, 2005. Hair O’ Dan, Friedrich W. Gustav and Lynda Dee Dixon. Strategic Communication in Business and the Professions. Pearson Education, 2008. Chaney Lilian and Jeanette Martin. Intercultural Business Communication, Fourth Ed.</p>	11	
5.48	<p><u>Project Like Experiments I</u> Small Projects</p>		3
5.49	<p><u>Project Like Experiments II</u> Small Projects</p>		3
5.50	<p><u>Project Like Experiments III</u> Small Projects</p>		3

Semester-VI

PAPER NO.	SUBJECT	Total hours	Session of 3 hrs
6.51	<p><u>Robotics and Automation in Biomedical Instrumentation</u></p> <p><u>Unit - 1</u> Robotics, Basic components, Classification, Performance characteristics, Drives and control systems, Electric, hydraulic and pneumatic actuators , control loops using current amplifier and voltage amplifiers.</p> <p><u>Unit - 2</u> Sensors and vision systems: Transducers and sensors, Tactile sensors Proximity and range sensors, vision systems, Image processing and analysis, image data reduction, segmentation feature extraction, Object recognition.</p> <p><u>Unit - 3</u> End effects, type Mechanical grippers, vacuum cups magnetic grippers, robot end effectors interface software for industrial robots. Positive stop program, point to point program and continuous path program. Applications of robots in biomedical field.</p>	15 15 15	3
6.52	<p><u>Principles of Diagnostic and Therapeutic Equipments-II</u></p> <p><u>Unit - 1</u> Principles of dialysis; hemo- dialysis.Electrical stimulators: strength-duration curve, types of stimulators, Electro-diagnostic / therapeutic stimulator.</p> <p><u>Unit - 2</u> Nerve-muscle stimulator Peripheral nerve stimulator, Ultrasonic stimulators, stimulators for pain and relief. Principles of cryogenic technique and application, Endoscopy Laparoscopy Thermography</p> <p><u>Unit - 3</u> Patient monitoring system - Intensive Care Unit (ICU), post operative, ICCU, single channel telemetry, multichannel telemetry. Transmission of biosignals over telephone lines. Digital central monitoring systems for patient monitoring. Computer based arrhythmia detection system.</p>	15 15 15	3
6.53	<p><u>Instrumentation of Imaging Techniques- II</u></p> <p><u>Unit - 1</u> Introduction to Computed Tomography (CT) scanning. Fundamentals of CT scanning: terminology related to equipment, introduction to basic blocks of equipment. Equipment parameters such as basic, single</p>	15	3

	<p>slice, spiral, multi-detector. GIT preparation, basic steps in CT scanning.</p> <p><u>Unit - 2</u> Basics in digital radiography. Computed tomography: Basic principles and history, X ray tube designing and construction, generation, Electron beam computerized tomography (EBCT), Concept of Hounsfield Unit (HU)</p> <p><u>Unit - 3</u> The magnetic resonance phenomenon for Magnetic resonance Imaging (MRI), Image formation Block diagram of MRI scanner, Description of each block.</p>	15	
6.54	<p><u>X-Ray Techniques- II</u></p> <p><u>Unit - 1</u> Grids: working principle, construction, applications and limitations.</p> <p>Radiographic tables: Design and construction. Mobile X Ray unit: Design and applications.</p> <p><u>Unit - 2</u> Image intensifier: Basic principle, construction. Digital image intensifier system</p> <p>Radiation detectors: Principles of design and construction.Applications of radiation detectors.</p> <p><u>Unit - 3</u> Protective equipments and their demonstration</p> <p>Administration: Care and maintenance of equipment. Maintaining log book. Disposal of used chemicals Methods of bio-waste disposal in radiology department.</p>	15	3
6.55	<p><u>Instrumentation of Artificial organs</u></p> <p><u>Unit - 1</u> Introduction to artificial organs: Biomaterials used in artificial organs and prostheses, inflammation, rejection, correction. Rheological properties of blood, blood viscosity variation: effect of shear rate, hematocrit, temperature and protein contents. Casson equation, flow properties of blood through the blood vessels, problems associated with extracorporeal blood flow.</p> <p><u>Unit - 2</u> Artificial heart-lung machine: Brief of lungs gaseous exchange / transport, artificial heart- lung devices. Oxygenators: bubble, film oxygenators and membrane oxygenators. Gas flow rate and area for membrane oxygenators.</p>	15	3

	<p>Liver support system, artificial pancreas, blood and skin.</p> <p>Unit - 3 Audiometry: Air conduction, bone conduction, masking, functional diagram of an audiometer. Hearing aids: different types, receiver amplifiers. Ophthalmoscope, retinoscope, I.A.B.P principle and application. Artificial limb and hands, prosthetic heart valves. Externally powered and controlled orthotics and prosthetics. Myoelectric hand and arm prostheses. The marcus intelligent hand prostheses.</p>	15	
6.56	<p><u>Wireless Communication assisted medical Instrumentation</u> Unit - 1 Introduction to Wireless Communication Wired Networks, Wireless Networks</p> <p>Differences between traditional data networks and Sensor networks Applications of Wireless Networks</p> <p>RF Fundamentals</p> <ul style="list-style-type: none"> • Radio frequency • RF parameters : <p>Gain, loss, diffraction ,scattering, VSWR,VSWR measurement, Effects of VSWR, and Solutions for VSWR</p> <p>Principles of antennas: LOS, NLOS, Fresnel zone, obstructions, antenna gain, directional radiator, EIRP</p> <p>Radio frequency mathematics: Measurement units(W, mW, Decibels, dB, dBi, dBm) Spread Spectrum Technology Antennas and supporting devices</p> <ul style="list-style-type: none"> • Omnidirectional • Semi directional • Highly directional. <p>Applications of all above</p> <ul style="list-style-type: none"> • Parameters: <p>Polarization, gain, beam width,Free space path loss, The 6dB rule</p> <ul style="list-style-type: none"> • POE <p>Wireless Networks organizations and standards</p> <ul style="list-style-type: none"> • FCC • ISM and UNII bands, advantages and disadvantages of license free bands <p>Power output rules: Pt to Pt, Pt to multipt</p> <p>IEEE standards for WSNs: 802.15.4, Bluetooth, RFID, etc. Basics and comparison.</p> <p>Unit - 2 Basics of Wireless Networks (WN) Technical aspects</p>	15	

	<ul style="list-style-type: none"> • Classifications • Single hop and multihop • Aggregating and non aggregating • Structured and randomly deployed • Self configurable and non self configurable • <p>Components of WN</p> <ul style="list-style-type: none"> • End devices • Routers • Coordinators • Operating modes: • Cyclic • Event driven • Polled <p>Network topologies, issues for topology design, Core Challenges in WN:</p> <ul style="list-style-type: none"> • Power consumption and battery life time • Bandwidth and response time • Reliability and stability <p>Hardware:</p> <p>Single node hardware:</p> <ul style="list-style-type: none"> • Sensors for WSN • Microcontrollers • Transceivers <p>WSNs as embedded systems</p> <p>Unit 3: Case studies of 4 wireless communication based medical instrumentation systems</p>	15	3
6.57	<p><u>Reliability and Quality Control Techniques</u></p> <p><u>Unit - 1</u></p> <p>Quality Concepts: Meaning of Quality, Approaches- Deming's Approach, Juran's Approach, Quality of Product, Quality of Service, Cost of Quality, Value of Quality, Difference between Inspection, Quality Control and Quality Assurance, Evaluation of Quality control, Quality Improvement Techniques Pareto Diagrams, Cause-Effect Diagrams Quality Circles, Kaizen, six sigma.</p> <p><u>Unit - 2</u></p> <p>Control Charts: Chance and assignable causes, Statistical Basis of the Control Charts (basic principles, choices of control limits, sample size and sampling frequency, rational subgroups, analysis of pattern on control charts, warning limits, ARL, sensitizing rules for control charts, Control Charts for X-bar& R (statistical basis, development and use, estimating process capability; interpretation, the effect of non- normality on the chart, the OC function, average run length and control chart for attribute (p, np, c)</p>	15	3
		15	

	<p>Unit - 3</p> <p>Acceptance Sampling: Meaning, objective and types of research, approaches, Principle of acceptance sampling, Producer's and consumer's risk. AOQL and LTPD, Sampling plans –single, double, O C curve</p> <p>Reliability: Different types and modes of failure, causes of failure in electronic components, reliability theory, hazard rate, failure density function, availability, maintainability, mean time to failure and repair system</p> <p>structures: series, parallel, K-type, reliability evaluation, optional reliability and redundancy allocation, Fault tree analysis</p> <p>Reference Books: D. C. Montgomery , Introduction to Statistical Quality Control, John Wiley and sons, 4th edition. Reliability Engineering by S. Shreenath, 4th Edition, East West Press.</p>	15	
6.58	<p><u>Activities :</u></p> <ol style="list-style-type: none"> 1. Project 2. Field visits 3. Short term Internship 4. Seminar 5. Group discussions 	45	3

List of Practical's

<p><u>Semester -I</u></p> <p><u>Chemical Science - I</u></p> <ul style="list-style-type: none"> ➤ Storage and handling of chemicals, handling of acids, bases, toxic and poisonous chemicals, MSDS, antidotes, threshold vapor concentration and first aid procedure ➤ Heating methods, stirring methods, filtration techniques, calibration of pipette, standard measuring flask and burette. ➤ Any Three Inorganic qualitative analyses without phosphate and borate removal, ➤ Mixture-1 (water soluble) ➤ Mixture-2 (water insoluble) ➤ Mixture-3 (water insoluble) ➤ Inorganic qualitative analysis of Binary Mixtures (including phosphate and borate removal). Sodium carbonate extract is to be used wherever necessary for detecting acidic radicals ➤ Determination of hardness of water from a given sample of water by EDTA method ➤ Analysis of alkali mixture by volumetric method ➤ To standardize NaOH solution and hence find the strength of given HCl solution ➤ To standardize KMnO₄ soln. and hence find strength of the given solution ➤ Estimation of percent purity of a given sample of sodium chloride ➤ Analysis of brass 	
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- Determination of Ca in presence of Mg by using EDTA
- Estimation of Al (III) from the given aluminum salt solution by using Eriochrome Black-T indicator (Back titration method).
- To determine amount of acetic acid in commercial vinegar
- Estimation of sodium carbonate content of washing soda
- The Separation and Identification of Metal Ions Using Paper Chromatography
- Crystallization with M.P. and percent yield of purified compound
- Distillation with B.P. and percent yield of purified compound
- Sublimation with M.P. and percent yield of purified compound

Physical Science Practical

- Standard operation procedure for Vernier caliper, micrometer screw and travelling microscope.
- Determine the combined focal length of given lens system.
- Determine the refractive index of material of prism using spectrometer.
- Determine the magnification of given microscopes.
- Determine the resolving power of microscope.
- Determine the radius of capillary using travelling microscope
- Determine the radius of curvature of plano convex lens by Newton's Rings
- Determine the thickness of thin foil using air wedge.
- Study I V characteristics of Solar cell.
- Measure the divergence of given laser.
- Determine the wavelength of light using plane transmission gratings
- Determine the numerical aperture of optical fibre.

Computer Science Practical - I

- To verify and design AND, OR, NOT and XOR gates using NAND gates.
- Design a Full adder and a full subtractor circuit.
- Design a 4x1 Multiplexer/ 3 to 8 decoder circuit using logic gates.
- Implement a function (4 variable) with logic gates , MUX , Decoder ICs
- Design a 4 bit parallel adder/subtractor circuit using 4 bit adder circuit IC
- Design a seven-segment Display driver.
- Using elementary gates build circuits for RS, Clocked RS, D, and JK Flip-Flop).
- Design a Modulo N Asynchronous and Synchronous Counter using D/T/ JK Flip-Flop ICs.
- Design a shift register using D/T/ JK Flip-Flops to study Serial and parallel shifting of data.
- To design a digital to analog converter of given specifications.

Biological Science - I

List of Practical:

1. Examining A Body Cell using the microscope, Staining a Cell Nucleus, Examining different tissues (e.g. of Intestine, skin, tongue, Skeletal muscle Testis)
2. Study of Human Skeleton, Study of Appendicular Skeleton, Bones of superior extremity Clavical, Scapula, Humerous, Ulna, radius ,carpal, metacarpal & phallenges,

3. Study of axial Skeleton Skull bone, Vertebral Column , Ribs & Sternum
4. Swallowing Functions
5. Examining the inspiration & expiration
6. To measure Pulse rate, Blood Pressure
7. Study of Skin, Examining the Body temperature, Taste and Smell sensations
8. Study of Reflex Action

Recommended Books:

11. C.C. Chatterjee (1992) Human Physiology (Vol. I, IV), 11th Edition, Medical Allied Agencies Calcutta
12. Ross & Wilson (1998) Anatomy & Physiology in health and illness, 6th Edition, ELBS, Churchill Livingstone, Medical Division of Longman group (FE) Ltd.
13. Devidson (1991) Principles & practice of medicine, 16th Edition, ELBS, Churchill Livingstone, Medical Division of Longman group (FE) Ltd.
14. Evelyn Pearce (1993) Anatomy & Physiology for nurses, 16th Edition, Oxford University Press Bombay
15. G.D.Tortora, Anatomy and Physiology Laboratory manual, Macmillan Publication

Semester -II

Chemical Science Practical

- To determine relative viscosity of given organic liquids by viscometer (Four liquids)
- To determine critical solution temperature of phenol water system
- To determine the rate constant (or to study kinetics) of acid catalysed ester hydrolysis
- To determine the rate constant of base catalyzed ester hydrolysis
- Partition coefficient of iodine between water and carbon Tetrachloride
- To compare the relative strength of HCl and H₂SO₄ by studying the kinetics of Inversion of cane sugar using Polarimeter
- To determine the molecular weight of a high polymer by using solutions of different concentrations
- To study the effect of addition of salt on critical solution emperature of phenol water system
- To determine the transport number of cation by moving boundary Method
- To prepare standard 0.2 M Na₂HPO₄ and 0.1 M Citric acid solution, hence prepare four different buffer solutions using them. Determine the Pka value of these and unknown solutions by Potentiometry
- To determine Pka value of given monobasic acid by Potentiometric titration
- To determine the formal redox potential of Fe²⁺/ Fe³⁺ system Potentiometrically
- To determine the amount of Cl⁻ and Br⁻ from the given halide mixture by titrating with silver nitrate solution by Potentiometry
- To determine Pka value of given weak acid by pH-metric titration with strong base
- To determine the dissociation constant of oxalic acid by pH-metric titration with strong base
- To determine pH of various mixtures of sodium acetate and acetic acid in aqueous solution and hence to find the dissociation of acetic acid by pH-metry
- To determine the cell constant of the given cell using 0.01 M KCl solution and hence determine dissociation constant of a given monobasic weak acid by Conductometry
- To estimate the amount of lead present in given solution of lead nitrate by Conductometric titration with sodium sulphate
- To investigate the Conductometric titration of any one of the following
 - a) Strong acid against strong base
 - b) Strong acid against weak base

- c) Strong base against weak acid
- d) Weak acid against weak base

Physical Science – II

- Y by bending
- Determination of coefficient of viscosity by Poiseulli's method.
- Demonstration of terminal velocity and coefficient of viscosity by falling sphere.
- Ultrasonic interferometer
- Sound intensity measurement

Biological Science II :List of Practical:

1. Microscopic observation of bacteria, microalgae, fungi, lichen and protists; Cell staining – Staining of Plant cell (onion epidermal cell), Animal cell (Squamous epithelial cell), Blood cell, Microbial cells (Bacteria & Yeast).
2. To study cell structure from onion leaf peels ; Shape and size of the cell–simple and differential staining
3. Cell division- Examination of various stages of mitosis and meiosis -mitosis (Onion root tip)& Meiosis (Tradescantia flower buds / grasshopper testes)
4. Polytene chromosome (chironomous larvae)

Recommended Books:

1. Lehninger A. (1981), Biochemistry, Butter Worth Publication.
2. Sheelk P. And Birch D.E. (1983), Cell Biology Structure, Biochemistry and function, John willey and sons.
3. Stryer L. (1981), Biochemistry, W.A. Freeman and Co.
4. Gerald Karp (1996), Cell and Molecular biology concepts and experiments, John willey and sons, Inc.
5. Loewy Sickevitz, Menninger, Gallant (1991), Cell structure and function, Sounders college pub.

Computer Science III Practical

- Study of Networking Devices
- Windows – Demonstration
- Windows – Installation
- Windows - Basic commands
- Windows - Network Configuration
- Linux – Demonstration
- Linux – Installation
- Linux - Basic Commands
- Linux- Advanced Commands

**Reliability and Quality Control Techniques Lab
(60 Lectures)**

Use latest statistical software package like SPSS

1. Descriptive statistics
2. Control charts for variable
3. Control charts for attribute
4. OC curve
5. Single sampling and double sampling
6. AOQ curve

PASSING STANDARD AND PERFORMANCE GRADING :

- 1) The minimum percentage required for passing will be 50% in each paper.
- 2) Evaluation: 60% periodic evaluation, 40% semester end examination

The PERFORMANCE GRADING of the learners shall be on the ten point scale be adopted uniformly for all courses.

MARKS	GRADE POINTS	GRADE
75 TO 100	7.5 TO 10.0	O
65 TO 74	6.5 TO 7.49	A
60 TO 64	6.0 TO 6.49	B
55 TO 59	5.5 TO 5.99	C
50 TO 54	5.0 TO 5.49	D
0 TO 49	0.0 TO 4.99	F (FAILS)

The performance grading shall be based on the aggregate performance of Internal Assessment and Semester End Examination.

The Semester Grade Point Average (SGPA) will be calculated in the following manner :

$SGPA = \frac{\sum CG}{\sum C}$ for a semester, where C is Credit Point and G is Grade Point for the Course/ Subject.

The Cumulative Grade Point Average (CGPA) will be calculated in the following manner :

$CGPA = \frac{\sum CG}{\sum C}$ for all semesters taken together.

R. _____ **PASSING STANDARD FOR ALL COURSES :**

Passing 50% in each subject or Course separately in Progressive Evaluation or (PE)/Internal Evaluation and Semester-End/Final Evaluation(FE) examination taken separately. i.e.(Internal and External Examinations are taken separately).

R. _____

Carry forward of marks in case of learner who fails in the Internal Assessments and/ or Semester-end examination in one or more subjects (whichever component the learner has failed and passing is separately in component).

A learner who PASSES in the Internal Examination but FAILS in the Semester-end Examination of the Course shall reappear for the Semester-End Examination of that Course. However his/her marks of internal examinations shall be carried over and he/she shall be entitled for grade obtained by him/her on passing.

A learner who PASSES in the Semester-end Examination but FAILS in the Internal Assessment of the course shall reappear for the Internal Examination of that Course. However his/her marks of Semester-End Examination shall be carried over and he /s he shall be entitled for grade obtained by him/her on passing.

R. _____ ALLOWED TO KEEP TERMS (ATKT)

A learner shall be allowed to keep term for Semester II irrespective of number of heads/courses of failure in the Semester I.

B learner shall be allowed to keep term for Semester III wherever applicable if He/she passes each of semester I and semester II

OR

A learner shall be allowed to keep term for Semester III wherever applicable irrespective of number of heads/courses of failure in the Semester I & Semester II.

C.A learner shall be allowed to keep term for Semester IV wherever applicable if he/she passes each of Semester I, Semester II and Semester III

OR

A learner shall be allowed to keep term for Semester IV wherever applicable irrespective of number of heads/courses of failure in the Semester I, Semester II, Semester III.

D. A learner shall be allowed to keep term for Semester V wherever applicable if he/she passes each of Semester I, Semester II Semester III and Semester IV

A learner shall be allowed to keep term for Semester V wherever applicable irrespective of number of heads/courses of failure in the Semester I, Semester II, Semester III and Semester IV.

D. learner shall be allowed to keep term for Semester VI wherever applicable he/she passes each of Semester I, Semester II Semester III Semester IV and Semester V

The result of Semester VI wherever applicable OR final semester shall be kept in abeyance until the learner passes each of Semester I, Semester II, Semester III Semester IV, and Semester V.

Architect of the Course

Theory Subjects

Industry training: Industry Project work for a duration of six months(24Credits).

Each Semester is 15 weeks

Project: Semester VI

1 Credit =15 Theory hours or 30 Practicals or 45 Project hours.