MAHATMA GANDHI UNIVERSITY

PRIYADARSHINI HILLS, KOTTAYAM - 686 560

RESTRUCTURED CURRICULUM AND SYLLABI

FOR

UNDER GRADUATE COURSES

IN

PHYSICS

1998

(Abstract)

tructured Curriculum and Syllabi for Under Graduate Courses - Model II Physics (Vocational) Electronic Equipment Maintenance - Change of to Applied Electronics - Approved - Orders Issued.

ACADEMIC AIII SECTION

.No.Ac AIII/2/206/99-3. Dated, Priyadarsini Hills, 6.7.2000

:- Minutes of the Workshop of the Core Committee in Physics held on 20.6.2000 at Baselius College, Kottayam.

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The Vice Chancellor subject to ratification by the Academic ncil has approved the change of name of the Model II B.Sc Physics cational) Electronics Equipment Maintenance degree course to B.Sc sics (Vocational) Applied Electronics as recommended by the Core mittee.

This will be effective from 1998 admission onwards.

Orders are issued accordingly.

Sd/-

MERCY THOMAS

ASSISTANT REGISTRAR(ACADEMIC)

for Registrar

1. The Principals of all Arts and Science College
2. The Convenor/Member of Core Committee in Physics
3. M.G.U Information Centres
4. PRO/Enquiry
5. PS to VC/PVC
6. PA to Regr/ICTC/CE
7. AR/DR/JR EL Sn.
8. DR EB Sns.
9. Ac AI/EBII & 9/ EL Sns.
10. SF/FC.

Forwarded/By Order

SECTION OFFICER

CONTENTS

PREFACE

With a view to update and reconstruct the degree courses under the Mahatma Gandhi University, the university has constituted core committees in different disciplines of study including physics. The University has decided to introduce the updated/restructured courses at the first degree level from 1998-99 academic year onwards.

The terms of reference of the committee in relation to respective committees are as follows:

1. Critically evaluate the merits/drawbacks of the existing curriculum
2. Project the present/future needs of the society and specific requirements of the learners.
3. Assess the extent/feasibility of changes in the existing academic/social context.
4. Subject recommendations to the university for updating/restructuring the curriculum .

In this context, the core committee in physics has gone through the various aspects of the present academic situation, has studied the broad objectives behind the programme, has consulted experts in various fields and disciplines related to the core subject and has designed and prepared draft syllabi one for the B.Sc. regular stream and one for a parallel stream i.e.; B.Sc. Vocational.

Before finalising the syllabi, the core committee has organized and conducted a five day work shop from 08th to 12th December, 1997 for the teachers in physics in which about 60 teachers representing different colleges affiliated to the M.G. University participated. The view points of the teachers were shared and taken into consideration.

An expert committee with Dr. V.P.N. Namboothri, CUSAT, Cochin and Dr. B. Jayachandran, S.N. College, Quilon met on 26th and 27th December, 1997 has gone through the syllabi and their suggestions have been incorporated while finalising the draft.

I thank all the members of the committee who have willingly and sincerely co-operated with me in this venture, all the members of my own department who have given expert advises in this regard and all the teachers of the affiliated colleges who have come forward to make this effort a grand success.

I am glad to present this report before the university with the recommendations and other proposals for the updating and restructuring the degree course in Physics on behalf of the core committee.

Convener
Prof.(Dr.) M. A. Ittyachen
Director
School of Pure & Applied Physics
Mahatma Gandhi University

GENERAL INTRODUCTION

The Present Scenario

The Core committee was asked to evaluate critically the merits and draw backs of the present curriculum. The committee has observed and studied the present academic scenario in detail and after having made long and effective discussions with the teachers and other experts in this field, has arrived at the following inferences.

1. The present curriculum is very much unscientifically framed which in no way, suits to the requirements of the present students who are trying to equip themselves to catch up with tomorrow's technology.
2. At present, much emphasis is given to the study of languages in all the undergraduate programmes and much of the valuable time is wasted, as content of the language component does not suit to the requirements of a science graduate.

3. A student opting for a particular main subject has only four hours of learning per week in that subject during that first year of study and only five hours per week during the second year of study and that too, in topics which can little generate interest and enthusiasm in him/her in that elected field. Since the time set apart for the study of main subject during the first two years of study is very small, he/she receives little attention from the leading department.

4. The growing unemployment problem, the craze of the youth to learn some job oriented courses and a poor set up and quality of the present under graduate curriculum have all turned away the students opting for the study of pure theoretical courses. It is sad to state, that the number of drop outs is increasing year by year.

5. As we are forced to retain the present structure of the curriculum, a mere updating and increasing the contents of the syllabi would do not help to renovate the present set up.

6. The committee is of the opinion that, the present academic scenario must be changed drastically to develop the learner's competence by evolving a learner-centred curriculum

7. Therefore in addition to updating and renovating the present curriculum of the existing undergraduate course a parallel vocational under graduate course in physics is to be introduced at the earliest.

Future Prospects

In this context, the core committee observes the following points

1. It is high time for updating and restructuring the undergraduate courses .

2. The ultimate aim and essence of all education is to draw out the innate capacities of the learner

3. The new approach to improving of courses does not mean overburdening of students.

4. The academic contents of subjects should be updated and the courses restructured with a view to increase the knowledge of the students as well as to enhance their employability

5. The practical and projects works done by a student exemplifies the principle of learning by doing. These educational exercises should be so designed as to link them with the theory of the related subject involving the active participating of the students

6. A course in research methodology may be made obligatory on the part of the students before they start a practical/project work.

7. Project laboratories/project libraries may be set up as a centralised facility in select centres/colleges for the use of all students

8. Practicals/projects should be assessed based on proper guidelines

MODEL 1
UPDATED SCHEME AND SYLLABUS OF THE EXISTING B.Sc PHYSICS

Introduction

The present syllabus for B.Sc. Physics is updated with following objectives

1. The new concepts and phenomena in Physics should be introduced more logically to strengthen the conceptional frame. This will help the students persuing higher studies.

2. As computers have become important and ubiquitos tools, a minimal exposure and training in computers shall form a part of the curriculum.

3. The student should be given an option to the study of a subject of their choice in more depth. The elective papers are introduced to meet this objective.

4. The student should get glimpses of the recent advances in science and technology to enthuse them for higher studies in Science.

5. The students should feel the Under graduate programme as a continuation of their studies in the plus two level. Duplication and overlapping of the topics are avoided wherever possible in the syllabus. However a review of the relevent topics already studied shall be made as a prerquisite

Recommendations

No structural changes are envisaged in Model 1. However, the Core committee make the following recomendations.

1. Of the six theory papers, one shall be an elective paper to be selected from the list of five papers given in the syllabus.

2. A College may be allowed to opt for atleast two elective papers, provided there are a minimum of 12 students opting for it.

3. The system of internal evaluation may be introduced as apart of the examination system.

4. Internal evaluation shall be objective, transpaprent with inherent mechanism for grievance redressal of students. General guidelinens for these may issued separately.

5. The present system of conducting practical examination by two external examiners may be changed toa system with one external examiner and one internal examiner.

6. Intense short-term traning programme (including practicals) may be conducted for teachers under the supervision of University centres or other centres of excellence.

7. Regional centres may be set up- as a common facility centre - with all modern equipments necessary to impart the training and skills to teachers and students.

8. University may take initiative in preparing and publishing Graduate level text books with the assistance of UGC

9. The existing pattern may be restructured by giving more emphasis to the learning of Physics and the related subjects. The time alloted for the study of languages may be reduced in the line proposed for Vocational courses.

Scheme of examination

	Marks Distribution		
	Internal	**External**	**Total**
First Year			
Paper-I Basic Electronics and Electricity	10	50	60
Second Year			
Paper-II Optics and Spectroscopy	10	50	60
Third Year			
Paper-III Mechanics	10	60	70
Paper-IV Solid State and Nuclear Physics	10	60	70
Paper-V Digital Electronics and Computer science	10	60	70
Paper-VI **Elective**	10	60	70
One of the following Subjects i) Astronomy and Astrophysics ii) Material Science iii) Optoelectronics iv) Radiation and Energy Physics v) Information Technology			
Total for theory	**60**	**340**	**400**
Practical-I Mechanics, Material Properties Optics and Magnetism.	10	30	40
Practical-II Electricity, and Electronics	10	30	40
Practical-III Digital electronics, Computer Scienceand Elective Paper	10	30	40
Practical Record	30	-	30
Project	-	30	30
Viva-Voce	-	20	20
Total for practicals	**60**	**140**	**200**
Grand Total for Physics	**120**	**480**	**600**

NOTE:-

Internal assessment

Internal assessment in thoery papers shall be based on the performance in class tests (minimumfour tests should be conducted), assignment (minimum for assignment should be given) and the percentage of attendance. The following division of marks shall be followed.

Class tests	assignments	attendance	Total
4	4	2	10

Internal assessment in practicals shall be based on a continuous evaluation of performance in doing experiments. Experimental skill, understanding of the principle, ability for data analysis, feel for accuracy, presentation, punctality etc; should be monitored while doing every expepriment. ***A record should be maintained by the teacher*** giving grade/mark for each experiment. The specified percentage of the average of these will be the final mark. The following division of marks shall be followed.

Skill	Knowledge	Presentation and punctuality	Analysis	Accuracy	Total
3	2	2	2	1	10

The valuation of Practical Record will be internal. The examination in practicals will be conducted by an external examiner and internal examiner. The project will also be evaluated by them. While evaluating the project credit must be given to innovative ideas and investigative projects. The projects shall be assigned to the students during the first year itself. All internal assessments shall be completed before the practical examination and the total marks may be published. Grievances if any, shall be heard and rectified by a committee constituted specifically for this purpose.

Pattern of Question Papers for theory.

Each question paper should have four sections.

For Papers I and II

Part A- Multiple choice questions.	8x1 = 8
Part B- Short answer questions	6x2 = 12
Part C- Essay type questions	3x5 = 15
Part D- Problems	5x3 = 15
Total	**50**

For Papers III, IV, V, and VI

Part A- Multiple choice questions.	10x1 = 10
Part B- Short answer questions	10x2 = 20
Part C- Essay type questions	3x5 = 15
Part D- Problems	5x3 = 15
Total	**60**

Allottment of periods

The number of period allot for theory and practical will be as follows

	Theory	**Practical**
First Year	2 hrs	2 hrs.
Second year	3hrs	2hrs
Third year	17hrs	8hrs

Study of the subject shall be using S.I units. A conducted study tour of students to Scientific and Industrial establishments shall form part of the curriculum. The use of calculators and computers may be permitted for data analysis.

Syllabus
Paper-I Basic Electronics and Electricity
UNIT-I

Diodes and their applications **(8 hrs)**

P-N junction diode, operation, characteristics, derivation of diode equation, PIV, dc and ac resistance, junction capacitance, switching time, temperature effects, power dissipation, diode data sheet, equivalent circuit. Different types of two terminal devices: Zener diode, Photo diode, solar cell, varactor diode, LED's - principle of operation and characteristics only. Applications: Rectification - Half wave and full wave rectifiers - circuit, ripple factor and efficiency (with derivation). Bridge rectifier - circuit- advantages- use of filters - Shunt capacitor filter, LC filter, RC filter.

Voltage multipliers, Clippers and Clampers.

Transistors **(8 hrs)**

Bipolar Junction transistor: PNP and NPN transistors - different configurations- CE, CB, CC- amplifying action -current gain- α,β, and their relationship, leakage currents in a transistor, Characteristics of transistor in the three configuration. Unipolar transistors : Field effect transistors-FET parameters (μ, r_d, g_m) - JFET's, and MOSFET's - principle of operation and their characteristics- relative merits.

Transistor Biasing **(5 hrs)**

Need for biasing- faithful amplification-selection of operating point-Bias stabilisation stability factor (definition only) -individual variation in transistor parameters - variation due to temperature. Biasing techniques- base bias- feedback resistor bias, voltage divider bias, Design considerations.

Transistor Amplifier **(7hrs)**

Amplifier classification based on operating point, frequency, coupling element Single stage CE amplifier with voltage divider bias- Analysis of the circuit using simplified h parameters- equivalent circuit- Expression for voltage gain, input impedance, output impedance. Frequency response curve of an RC coupled CE amplifier Multistage amplifiers- DC coupled, RC coupled and transformer coupled amplifiers and their advantages and disadvantages. Power amplifiers - class A, class B, class C operations. Push pull complimentary symmetry transistor amplifiers.

UNIT-II

Feed back Amplifiers **(3 hrs)**

Principle of feed back circuits, Stabilisation of gain by negative feed back reduction of non -linear distortion by negative feed back Effect of feed back on input and out put resistance's. Voltage series feedback, Emitter follower, Current series feed back.

Oscillators **(4 hrs)**

Feedback requirement for Oscillators. Basic Oscillator analysis. Phase shift Oscillators, Hartely and Collpits Oscillators, Piezo-electric crystal oscillators.

Operational Amplifiers **(3 hrs)**

Characteristics of an op-amp, circuit symbols. Op-amp as an inverting and non inverting amplifier, summing amplifier, integrator and differentiator circuits. Operational amplifier as a differential amplifier. Phase shift oscillator using OP-Amps.

Modulation and Demodulation **(5 hrs)**

Principle of modulation. Amplitude Modulation - frequency spectrum of AM wave, demodulator. FM modulation - FM generation using varicap diode- FM demodulation, slope detector. Receiving Systems- Superheterodyne principle (block diagram only). Principles of Television systems

Power Supplies **(7 hrs)**

Voltage regulation- definition- shunt regulators. Voltage regulator circuits using Zener diode and transistor- Regulator circuits using transistor and IC's - Regulator circuits using voltage regulator IC's. Three terminal voltage regulator IC's (familiarisation only). Switching Mode Power Supply (SMPS) and Inverter circuits (Basic ideas only).

Network Analysis **(5 hrs)**

Network analysis - reduction of complicated networks using Equivalence of T and II networks, Thevenin's theorem, Norton's theorem, Superposition theorem ,Maximum, Power transfer theorem.

Transient Currents **(3hrs)**

Charging and discharging of a condenser through a LR circuit. Multivibrator

Alternating Current **(6hrs)**

Alternating Currents - peak and RMS values of A.C- use of j operator - reactance and impedance in AC circuits. Theory of series resonant circuits. Selectivity Q of a coil, practical applications of LCR circuit in tuning an aerial. Parallel AC circuits. Parallel resonant circuits. Power in AC circuits, Power factor. Anderson's Bridge.

Fundamentals of power transmission **(5hrs)**

Single and three phase power. Transformers and their use in power transmission. Power losses in a transformer. Systems of transmission. Transmission loss due to frequency variation , peak load, base load and average load. Energy preservation. Choke coil and its use. Power factor correction using capacitor. Single phase rotating magnetic fields, Theory of induction motor

Measuring Instruments **(4 hrs)**

Ballistic Galvanometer-construction and working-measurement of charge (with theory).

Multimeter- analogue and digital multimeters.

Cathode Ray Oscilloscope (CRO) - Basic principle of operation- measurements.

Books for Study and Reference

1. Electronic devices and Circuit Theory- Robert Boylestad and Louis Nashelski (Prentice Hall)
2. Electronic Devices and Circuits-Allen Mottershed
3. Electronic Fundamentals and applications- John D.Ryder (PHI)
4. Electricity and Magnetism-Kip
5. Fundementals of Electricity and Magnetism - D.N.Vasudeva
6. Basic Electrical Enginneering - Thereja
7. Integrated Electronics -Millman and Halkias (McGrawHill)
8. The art of Electronics- Horowitz and Hill (Cambridge University Press)
9. Principles of Communication Systems- Taub and Schilling (TMH)
10. Network thory and filter design - Aatre (wiley Eastern)
11. Power Supplies - B.S.Sonde (TMH)
12. Elements of electronic instrumentation -Jha, Puri, Suereshkumar and Kowar (Narosa)

Paper -II Optics and Spectroscopy

UNIT-I

Interference **(20 hrs)**

Analytical treatment of interference, theory of interference fringes and band width- Biprism experiment- thickness of a transparent film. Interference in thin films- reflected and transmitted systems, Fringes of equal inclination- Newton's rings- reflected and transmitted system- refractive index of a liquid by Newton's rings. Newton's rings formed by two curved surfaces, wedge shaped films- fringes of equal thickness, testing of optical flatness. Interferometers- Michelson's interferometer- determination of wavelength, difference of wavelength and standardization of wavelength. Fabriperot interferometer (qualitative only)

Diffraction **(20 hrs)**

Phenomena of diffraction, Fresnel's assumptions-explanation for apparent rectilinear propagation- zone plate- comparison of zone plate and convex lens. Fresnels diffraction at straight edge, slit and thin wire, diameter of a thin wire. Franhofer diffraction at a single slit, double slits, N slits, plane diffraction grating- Normal and oblique incidence - orders of spectra- dispersive power. Resolving power of optical instruments- Raleigh criterion, resolving power of telescope, microscope, prism and grating spectrogrpahs

Polarisation **(15 hrs)**

Experiments showing transverse nature of light, plane polarised light, polarisation by reflection, Brewsters law- pile of plates, law of Malus. Double refraction, construction of Nicol prism, Nicol prism as a polariser and analyser. Huygens explanation for double refraction- construction of wave surface. Experimental determination of principal refractive indices, double image prisms. Quarter and half wave plates. Production and analysis of plane, circularly and elliptically polarised light- Babinets compensator, dichroism Polaroid and its uses. Optical activity- Fresnels explanation and experiment. specific rotation, Laurents half shade and bi-quartz polarimeters

UNIT-II

Lasers **(13 hrs)**

Basic principle of laser operation, Einstein coefficients, light propagation through a medium and condition for light amplification, population inversion, threshold condition, line shape function, optical resonators (theory not required). Q-factor- Various laser systems - Ruby laser, Nd-YAG laser, He-Ne laser, CO_2 laser, dye laser semiconductor lasers (working principles only)- Applications of lasers.

Holography **(8 hrs)**

Principle of holography- recording of holograms- theory of reconstruction of images-characteristics of holograms- practical applications of holography- different types of holograms- transmission and reflection types.

Fibre optics **(7 hrs)**

Principle of fibre optics - numerical aperture - single mode and multimode fibre-coherent bundle- pulse dispersion in fibres- material dispersion- fibre optic sensors- displacement, temperature, electric filed and magnetic field- fibre optic communication (qualitative)

Dispersion **(8 hrs)**

Normal dispersion, Cauchi's and Hartmann dispersion formulae, Elementary theory of dispersion, Anomalous theory of dispersion , Woods experiment for anomalous dispersion of sodium vapour

Spectroscopy **(7 hrs)**

Vector atom model and atomic spectra of hydrogen and alkali atoms. Molecular spectra- rotational and vibrational energy levels-selection rules. Energy levels of a diatomic molecule - rigid rotator and Harmonic oscillator approximation. Qualitiative ideas on band structure of electronic spectrum. Classical and Quantum theory of Raman effect, Experimental Study.

Electromagnetic theory **(12 hrs)**

Electromagnetic waves- Maxwells equations- displacement currents- Propagation of electromagnetic waves in isotropic dielectric media, Equation for plane waves, Poynting's theorem Poynting's vector-dependance of polarisation on electric filed-brief discussion on non linear optics. Production and detection of electromagnetic waves.

Books for Study and Reference

1. Text Book of Optics- Brijlal and Subramanyam (S.Chand & Co)
2. Optics- Ghatak- (TMH, 2/e)
3. Lasers and non-linear Optics- B.B.Laud (Wiley Eastern)
4. Fundementals of Optics- Jenkins and White (McGrawHill)
5. Fundementals of Molecular Spectroscopy- Banwell (McGrawHill 3/e))
6. Physical Optics- Wood
7. Optics - Matveev (MIR)
8. Lasers Physics and Applications -Tarasov (MIR)
9. Electromagnetics- B.B.Laud (Wiley Eastern)
10. Lasers - Thoery and applications- Thyagarajan and Ghatak (McMillan)
11. Molecular Spectra and molecular structure -G.Herzberg (VanNostrand, London)

PAPER -III Mechanics

UNIT-I

Mechanics of a system of particles **(15 hrs)**

Review of- Basic ideas of frames of reference, Conservation laws, General equations of motion, Types of forces, Force on charged particles in electric and magnetic fields. Conservation of momentum, Constrained motion, Constraint forces, De Alemberts Principle, Generalised coordinates, Lagranges Equations, Simple applications of Lagranges Equations, Calculus of Variation, Hamiltons Principle, Derivation of Lagranges equations from Hamiltons Principle. Hamiltonian- Hamiltons modified principle- canonical equations.

Two body Central force problems **(13hrs)**

Expression for radial and tangential accelerations from first principles. Reduction to equivalent one body problem, Equation of motion and first integrals Equivalent one dimensional problem, Differential equations for the orbit, the integrable power law, Keplers Problem- Inverse square law of force, Scattering in a central force fields.

Oscillation and Waves **(15 hrs)**

Linear differential equations, Harmonic motion and circular motion, Damped oscillations, Forced oscillations, Electrical resonance, Oscillation in linear systems, Analogues in Physics- Series and Parallel impedances. Differential equation of wave motion

Fluid dynamics **(12 hrs)**

Equation of continuity for a fluid,. Eulers Equations- Bernoullis equation- Bernoullis theorem. Laminar flow through a pipe- transition to turbulent flow. Viscosity- Poiseulles formula (with derivation)-Rotation Viscometer.

Special theory of relativity **(15 hrs)**

Motion and rest- inertial frames of reference- Galilean transformation- Michelson Morely Experiment. The theory of relativity - postulates - Lorentz transformation- spatial contraction time - dilation. Relativity of simultaneity, addition of velocities, conservation of momentum and variation of mass with velocity. Mass energy relation. Causality, Relativistic invariance, space-time diagrams and energy-momentum four vectors.

UNIT-II

Formulation of Quantum Theory **(20 hrs)**

An overview of mathematical techniques-Limitations of classical Physics, (Black body radiation, Photoelectric effect, Stern-Gerlach experiment), Matter waves and de Broglies hypothesis, Uncertainty principle, First principles of Quantum mechanics, Three dimensional wave packet, group velocity, phase velocity - uncertainty relation for a wave packet, one dimensional wave equation, Generalisation of wave equation.

Schrodinger wave Function **(15 hrs)**

Time independent wave equation, Time dependent wave equations, Wave equation for a free particle, Statistical interpretation of wave equation, Normalization of the wave function, Probability current density, Expectation value of dynamical variables, The eigen value equation. Basic ideas of Quantum Mechanical operators, commutator brackets.

Applications of QM- simple cases **(6hrs)**

Particle in a box problem, Linear harmonic oscillator, One dimensional square well potential, Square barrier- tunnelling, alpha decay (qualitative). Quantisation of angular momentum.

Thermodynamics **(9hrs)**

Entropy - Change in entropy- available and unavailable energy- Heat death - Entropy and disorder- Third law of thermodynamics- Maxwells thermodynamic equations- Clausius Clapyron equations- Negative specific heat- Definitions- Potential, Enthalpy, Gibb's functions, Helmholtz function.

Phase transition and Critical phenomena **(5 hrs)**

Phase diagram of a simple substance, First order phase transition. Kirchoffs equations. Higher order phase transitions, Liquid helium. Super fluidity.

Description of a system **(8hrs)**

Microstates and Macrostates, Statistcal ensembles, Phase space, Liouvelles theorem, Velocity distribution, Maxwell Boltzman distribution, Equi-partition of energy. Entropy and probability - Thermodynamic functions of a monatomic gas- partition function

Quantum Statistics **(7 hrs)**

Indistinguishability of identical particles, Bose- Einstein and Fermi-Dirac distribution functions, Comparison of the three statistics. Application of BE and FD statistics- Bose-Einstein condensation, Thermionic emission

Books for Study and reference

1. Classical Mechanics-Goldsteins (Narosa)
2. Fluid Mechanics - Landau and Lifshitz
3. Thermodynamics - Zeemansky (McGrawHill 6/e)
4. Theoritical Chemistry - Glastone
5. A Text Book Of Quantum Mechanics- Mathews and Venketesan (TMH)
6. Special Theory of relativity - Resnick
7. Classical Mechanics - Rana and Joag (TMH)
8. Mechanics-J.C.Upadhyaya (Ramaprasad and Sons)
9. Quantum Mechanics- A.Goswamy (Wm.C.BrownPublishers)
10. Theory of Relativity- R.K.Pathria

11. Statistical Mechanics- Kerson Huang (WileyEastern)

Paper-IV Solid State Physics and Nuclear Physics

UNIT-I

Crystal Structure **(15 hrs)**

Arrangement of atoms and molecules- periodicity-translational vectors and lattices- unit cell- Miller indices, Symmetry operations and three dimensional lattice types. Reciprocal lattice and its properties- Hexagonal close packed structure -Some simple crystal structures (NaCl, CsCl and diamond) Elementary ideas of X-ray diffraction - Braggs law, Powder diffraction method.

Crystal Binding **(6 hrs)**

Binding Energy and Cohesive energy of crystals, different types of Bonding in crystals and their nature. van der Waals bond, ionic bond, covalent bond, hydrogen bond.

Lattice Vibrations and thermal properties **(10 hrs)**

Lattice vibrations- quantization- phonons. Vibrations of monatomic and diatomic linear lattice and their phonon spectrum, Scattering of phonons by neutrons. Experimental technique to obtain phonon spectrum. Lattice heat capacity- Einstein's Model- Limitations- Debye's model (Qualitative).

Electron theory **(15 hrs)**

Essential features of free electron theory, Energy values and density of states, Fermi level. Motion in periodic potential, origin of band gap, distinction of materials based on their band gap, Concept of holes. Explanation of electrical conduction in metals and semiconductors. Effect of doping on the Fermi level in Semiconductors

Super Conductivity **(9 hrs)**

Concept of zero resistance, Types of super conductors- Type I & II super conductors Meissner effect, isotope effect, BCS theory (qualitative)- Josephson effect, SQUID , High Tc superconductors Applications

Dielectric and Magnetic properties **(15hrs)**

Polarisation, macroscopic electric field, depolarisation field, local field of an atom ,dielectric constant and polarisability. Ferroelectric crystals.

Magnetic properties of solids: dia, para and ferro magnetism. Ferromagnetic domains and their properties. Cycle of magnetisation, hysteresis, B-H curve, circulation of energy due to hysteresis, Adiabatic demagnetisation

UNIT-II

Atomic Nucleus **(20 hrs)**

Properties-nuclear forces, spin, negative moment, electron nuclear interactions. Discovery of neutron - its mass and decay - concept of nuclear isotopes and isobars. Stability of nuclei - stability and neutron number - alpha and beta decay - positron emission, electron capture. Nuclear size and shapes, Binding energy - fission and fusion.

Nuclear models **(10 hrs)**

The liquid drop model. The Shell model - origin of magic numbers - compatibility of liquid drop model and shell model. Meson theory of nuclear forces.

Radio Activity **(20 hrs)**

Radio active decay - unit of activity- the Bequerel and Curie - Decay formula - half life - mean life. Radiometric dating - Biological and Geological. Radio active series - 4 series - branching - radio- active equilibrium. Alpha decay - Gamow's theory. Beta decay - the neutrino hypothesis - positron emission and electron capture - discovery of neutrino - inverse beta decay. Gamma decay - Internal conversion - nuclear isomers. Radiation hazards - radiation dosage.

Elementary Particles **(15 hrs)**

Elementary ideas on particle accelerators-Classification and properties- Leptons - Baryons and Mesons Guage particles, Elementary particle quantum numbers. Symmetries and Conservation Principles - Conservation momentum, energy, angular momentum, parity - Parity Violation and CPT conservation. Elementary ideas of Quark model . Fundamental interactions - strengths and ranges - unification of forces of nature - standard model and grand unified theory (concept only).

Cosmic Rays **(5 hrs)**

Some basic ideas of particle detectors- ionisation chambers- Geiger Muller counter. Discovery-nature-latitude effect- east-west effect- Cosmic ray showers - Bhabhas thory- Origin of cosmic rays.

Books for study and Reference

1. Solid State Physics-J.S.Blackmore(Saunders Int. Student Edn).
2. Solid State Physics- H.C.Gupta (Vikas Pub House Pvt.Ltd.)
3. Intoduction to Solids -Azaroff (TMH)
4. Solid State Physics - J.Christman
5. Nuclear Physics - Kaplan
6. Atomic and Nuclear Physics - Gupta and Ghosh (Books and Allied Pvt.Ltd)
7. Introduction to superconductivity- A.V.Narlikar &Ekboto
8. Concepts of Nuclear Physics-Cohen
9. Nuclear Physics- Yadav and Pandya
10. Modern Physics - R.Murugesan (S.Chand & Co)
11. Elementary particles and Symmetries-L.H.Ryder
12. Solid State Physics - Gerald Burns (AcademicPress)
13. Introduction to Solids - AliOmar

Paper-V Digital Electronics And Computer Science

UNIT-I

Number Systems **(10 hrs)**

Different number systems- decimal- binary- -octal- hexadecimal - conversion between different systems- Binary mathematics-addition -subtraction - BCD.

Boolean Algebra **(5 hrs)**

Boolean Operations - Basic theorems of Boolean Algebra - DeMorgans theorems -Boolean Functions- Canonical and standard forms Simplification of Boolean Functions - conversion of truth table to Boolean expressions

Digital logic Gates **(20 hrs)**

AND, OR, NOT, ,NOR, XOR, NAND gates and their truth table. TTL and CMOS gates.
Adders- Half adder-full adder. A 4 bit adder-subtractor. Encoders , Decoders, Multiplexors and Demultiplexors.

Counters and registers **(20 hrs)**

Flip-flops: RS flip- flop, clocked RS, JK flip-flops, JK master slave, T and D flip flops. Registers-Shift registers-Ripple Counters, Decade and divided by n counters. Digital to Analogue Conversion using R -2R ladder network. Analogue to Digital Conversion -counter type converter.

Microprocessors. **(15hrs)**

Introduction to microprocessors - Bus concept and tristate logic -Functional description of 8085 microprocessor- general purpose registers, ALU, Data bus, Address bus, Control bus , memory and I/O ports. Address decoding- Overview of 8085, instruction set, simple programmes for data transfer and arithmetic operations - Basic ideas of interfacing, general ideas on advanced microcomputers.

UNIT-II

Basic architecture of a computer **(5 hrs)**

Characteristics of a computer- Speed-Storage -Accuracy- versatality.

Hardware **(10 hrs)**

Input and output devices- keyboards- mouse - printers -VDU
Memory and storage devices -RAMS-ROMS - primary - secondary - hard discs - floppy discs- CD's.

Software **(30 hrs)**

Operating systems
WINDOWS 95 - DOS (working knowledge)
Need of software -machine language- assembly language -high level language - flow charting- algorithms typical high level language - BASIC or C-Application Software - spread sheet - database management

Applications **(25 hrs)**

Numerical Methods- Iteration Method- Method of False position- Newton Raphsor Method- Forward and backward formula - graphical method - Bisection method- numerical differentiation - Numerical integration- trapezoidal rule- Simpson rule- Rengekutta Method- Picaids method of successive

approximation- Eulers Methods Curve fitting- Linear regression- least square fit- linear parabolic interpolation- Lagrange interpolation-Basic ideas of Mathcad.

Books for Study and Reference

1. Digital Principles and Applications- Malvino and Leach (McGrawHill)
2. Digital logic and Computer design- Morris Mano
3. Fundementals of Computers - V.Rajaraman (PH 2/e)
4. Programming in BASIC- Balaguruswamy (TMH)
5. Pulse, Digital and switching wave forms- Millmann and Taub
6. Digital Electronics- William Gothaman
7. Introduction to Microcomputer- Malvino
8. Numerical Methods - V.Rajaraman
9. ANSI C - Balaguruswamy
10. Microprocessor Architecture, Programming andApplications - Gaonkar (Wiley)

SYLLABI FOR ELECTIVE SUBJECTS (PAPER VI)

Elective -I Astronomy and Astrophysics

UNIT-I

General introduction **(20 hrs)**

Historical development of astronomy- Observational methods and scope of astronomy - physical properties- apparent and absolute magnitude -luminosity - measurements of distances, mass, radius etc. of stars, spectral classification - HR diagram.

Spherical Astronomy- celestial coordinates horizontal system equatorial system ecliptic system conversion of coordinates sidereal time latitude of a place right ascension and declination of a body Hour angle at the time of rising and setting duration of a day

Observational Methods **(10 hrs)**

Optical telescopes- resolving power-light gathering power of a telescope- telescope mounting- diffrent types telescope - photometer-optical filters- CCD - X-ray astronomy- radio astronomy- radio telescop

Identification of Constellations **(10hrs)**

Zodiacal constellations- seasonal changes of the night sky- winter spring- autumn and summer constellation Indian and western names of constellations and stars.

Sun **(15hrs)**

Physical characteristics- sources and transport of energy atmosphere -chromosphere- solar corona- sun spots - limb darkening- solar cycle solar magnetic field -plasma eruptions- solar flares. Solar neutrino problem

Solar system **(15hrs)**

Constituents of solar system -regularities and irregularities motion of planets and satellites retrograde motion thoeries on the evelution of solar system

UNIT-II

Stellar evolution **(25 hrs)**

Stellar structure- Differential equation for stellar structure- protostar- main sequence- red giant- white dwarfs-supernova- Chandrasekhar limit(Derivation required)- - -planetary nebulae-neutron stars -black holes.

Peculiar objects **(10 hrs)**

Variable stars- cephid variables distance estimate- ALGOL- binaries- pulsars- quasars- multiple stars- globular clusters.

Galaxies **(10hrs)**

Our galaxy- different types of galaxies- groups of galaxies motion of galaxies super cluster large scale structure of the universe

Cosmology **(25 hrs)**

Early models of Universe Cosmological principle Weyel postulate Einstein deSitter model Freidman model Red shift Hubbles law Expanding Universe Big bang Gamows hot big bang model -cosmic microwave background radiation- Evolution of matter from energy- Steady state theory -QSS model of Narlikar- Dark matter in the Universe - inflationary model - and large scale structure formation Universe.

Books for Study and reference

1. Astronomy-Kumaravelu and SuseelaKumaravelu

2. Astrophysics -A modern perspective, ed K.S.Krishnaswamy- New Age Int Lt Pub.Bangalore-1996
3. The first three minutes- S.Weinberg
4. Introduction to Cosmology- J.Nar;likar
5. Stellar interiors- Hansen & Kawler
6. An introduction to Astrophysics - BaidyanathBasu (PHI 1997)
7. Astrophysics -Stars and Galaxies- K.D.Abhayankar (Tata MacgrawHill -ND-1992)
8. Discovering Astronomy - Robert Robins and William Jefereys, (Wiley, NY1998)
9. Structure of the Universe-J.Narlikar (Oxford University Press)

Elective -II Material Science

UNIT - I

Introduction **(10hrs)**

Scope of the science of materials, Review of:- atomic structure, intermolecular forces, classification of materials and their properties, interactions and bonds - short ranged & long ranged interactions and interaction potentials.

Main engineering materials **(40 hrs)**

Glassy metals, Non metallic solids - semiconductors , polymers

Ceramics Ceramic forming methods- principle of pressure fabrication- maximising packing fraction and minimising wall and particle friction in dry processing hydroplastic forming- sintering procedures- cermets. Properties of ceramics- electrical, magnetic and optical properties (Basic ideas only)

Composite materials Classification and definition- fibres and matrices- carbon fibres, glass fibres- organic fibres - fibre composites - cements - concrete, , laminates, wood and cellulose materials.

Defect and Diffusion in materials **(10 hrs)**

Point defects-line defects -surface defects-volume defects-production and removal of defects-(Quenching, Deformation, Irradiation and annealing)-recovery, recrystallisation and grain growth-diffusion in solids-atomic model of diffusion-Ficks law of diffusion-Inter diffusion and Kirkendall effect.

UNIT II

Mechanical and corrosion properties **(40 hrs)**

Stress and strain, Hooke's law of modulus of materials- stress and strain diagrams -strength -elasticity-Stiffeners- resilience -plasticity- ductility and malleability-toughness-hardness, hardenability and brittleness -lubrication-tensile test-compression test-hardness test-impact test-fatigue test-creep and stress rapture test. Introduction to corrosion-mechanism of electrochemical corrosion -corrosion control- mechanism of oxidation- -oxidation resistant materials.

Crystal Growth **(25 hrs)**

Methods of single crystal growth - Czochralski - zone melting - and solution growth techniques. Thin film preparation techniques - Thermal evaporation- vacuum evaporation, flash evaporation; Sputtering- DC sputtering; Chemical methods- electro-deposition, spray pyrolysis, chemical bath deposition;

Material Characterization Techniques **(15 hrs)**

Structural analysis - X-ray diffraction (XRD) technique; Scanning Electron Microscope (SEM); Compositional analysis- Electron Scanning for Chemical Analysis (ESCA); Optical analysis-Spectrophotometer; Electrical characterization using HALL measurement systems

Books for Study and Reference

1. Materials Science and Engineering, a first course, 3rd Edn. V. Raghavan (Prentice Hall of India)
2. Introduction to Materials Science and Engineering -Ralls , Cartney and Wolf (Wiley Eastern)
3. Science of materials - Broston (Wiley)
4. Solid state physics for Metallurgist- Weiss (Pergamon)
5. Thin Film Phenomena- K.L.Chopra (McGraw-Hill, NewYork)
6. Thin Film Technology- F.A.Lowenheim (J.L.Vossen and W.Keru, Eds.) (Academic Press, New York 1978)
7. Instrumental Methods of Analysis- 6th Edn., Willard, Merritt, Dean, Seatle (CBS publishers , Delhi)
8. Practical Surface Analysis by Auger and X-ray Photoelectron Spectroscopy, D. Briggs and M.P. Seah (Eds.) (John Wiley & Sons, New York ,1987)
9. Science of Engineering Materials - Manas Chanda, Vol 1 + 2 LCUE edn. 1979.
10. Materials Science- R-S Khurani & R.S. Sedha S.Chand & Co. Ltd., (2/e) 1989

Elective-III Optoelectronics

UNIT - I

Introduction **(3hrs)**

Radiometric units- photometric units- point sources-extended sources-diffuse reflector-image-luminescent phenomena

Optical process in semiconductors **(20hrs)**

Electron-hole pair formation and recombination-radiative and non radiative recombination, Band to band recombination. Absorption in semiconductors - indirect transitions, Exciton absorption, Donor-Aceptor and impurity band absorption - Fanz Keldysh and Stark effect- absorption in Quantum well structures - radiation in semiconductors- Stokes shift- Deep level transitions-Auger recombination-Luminescence from Quantum wells- Time resolved photoluminescence

Semiconductor heterojunctions **(5hrs)**

The ideal heterojunction- current -voltage characteristics-applications

Light emitting diodes **(10hrs)**

Electroluminescent process- choice of LED materials- injection- recombination and conversion efficiencies- light output from LED- LED structures- heterojunction LED, Edge- emmitting LED, Device performance, I-V characteristics , spectral response, frequency response - manufacturing processes.

Semiconductor Lasers **(5hrs)**

Junction laser operating principles-heterojunction lasers, Distributed feedback lasers, Quantum Well lasers Long wavelength semiconductor lasers

Photodetectors **(10hrs)**

Photoconductors - junction photodiodes - PIN and APD - high speed measurements -phototransistor- modulated barrier photodiodes - Schottkybarrier photodiode - MSM photodiodes- detectors for long wavelength operations- microcavity photodiodes.

Solar cells **(15hrs)**

Basic principle of operation, Characteristics -I-V Characteristics , spectral response heterojunction and cascaded solar cells-Schottky barrier solar cells. Thin film solar cells- materials and design considerations- Recent trends in solar cell fabrications.

Optical isolators and PMT's. **(2hrs)**

UNIT -II

Modulation and switching devices **(30hrs)**

Direct modulation of SDL, direct modulation of LED's- external modulation- Pockel cells- phase modulation -wave guide modulators- quantum well modulators- acousto-optic and magneto- optic modulators- basic ideas of non linear optics-optical second harmonic generation, frequency conversion- optical switching and logical devices -self electro optic devices- bipolar controller modulator- memory devices.

Display devices **(20hrs)**

Liquid crystals Physics of liquid crystals- LCD display- Electroluminescence- materials for EL display, plasma displays, numeric displays, CCD

Integrated optics- Optical integrated circuits- optical switches- A/D convertors- spectrum analysers- convelutersand correlators- Integrated optic sensors optical logic components

Optical Communnication **(20hrs)**

Optical fibre- characteristics and fundemental parameters- propagation modes- low loss fibres- transmission distance with optical fibres- examples of optical transmission techniques- instrumentation and controll with optical fibres

Books

1. Semiconductor- Optoelectronic devices- P.Bhattacharya (PHI)
2. Opto-electronics- Texas Instruments (McGrawHill)
3. Opto-electronics - Wilson and Hawker
4. Monochrome and Colour TV- R.R..Gulaati
5. Optics and lasers-An Engg. Physics approach- M.Young (Springer-Verlag)
6. Opto-electronics -Yaspir Sing
7. Optcal fibre Communications- Suematsu and Toa (John Wiley)

Elective -IV Radiation And Energy Physics

UNIT - I

Radiation in the environment **(25 hrs)**

Introduction - types of radiation- different types of interaction of radiation with matter- photoelectric effect- Compton effect- elastic scattering- pair production. The probability for different interactions at different energy ranges- multiple scattering -Back scattering. Radiation damage-Cosmic rays Ultra violet radiation. radiation units and measurements- radioactive decay- laws

Radiation Hazards **(25 hrs)**

Man made radiation and human health-Radiation fall out- Nuclear fission and fusion-recognition of danger from radiation short term and long term effects-Gofmann and Tamplin radiation standards-genitic mutation-Hermanmuller experiment -Doss effect curve

Air Pollution **(20 hrs)**

Pollution of the air- Air pollution incidents-temperature inversion-gaseous pollutants of the air-sulphur dioxide and nitrogen dioxide- photochemical smog-particulate-lead and asbestos pollution - Light pollution in sky-unwanted illumination

UNIT II

Different forms of Energy **(15hrs)**

Energy fundamnetals-different types -energy units and interconversions efficiency of devices-Renewable and Non-renewable engergy forms and Global potential- Energy demand and supply future projection Cost comparison for different sources of energy

Solar energy **(25hrs)**

Sun as the ever lasting source of energy-Nature of Solar radiation-components-Solar thermal devices-Solar heaters- Agricultural driers- Solar cooker-solarstill- solar pond space cooling and heating

Solar photovoltaics- photovoltaic cells- energy storing batteries-solar cells, crystal wafer cells-thin film solarcells-cost effectiveness of various solar cells. Current trends
in photovoltaics

Wind Energy **(5 hrs)**

Wind velocity and wind power- selection of sites wind mills mechanical- electrical-different forms of propellors efficiency

Ocean Energy **(10 hrs)**

Ocean thermal energy Potential-OTEC Plants design and efficiency Tide Energy- potential-trapping techniques-available sites; Wave energy- Trapping devices -potential- sites current production and future

Geo Thermal Energy **(5hrs)**

Geo-thermal sources ancient use- hot spring potential geo-thermal electric plants-current energy production future trends

Bio-Energy **(10 hrs)**

Biomass energy- classification photosynthesis-bio mass conversion processes-bio gas plants-disadvantages-and advantages

Books for study and reference

1. Physics, The Envirnment and man-Isac Turiel
2. Atomic Nucleus - R.D. Evans.
3. Solar Energy -Principles of thermal collection and storage - S.P.Sukhatme (TMH, 2/e)

Elective - V Information Technology

UNIT-I

(70hrs)

Inroduction

Introduction to Information Technology - different types , CPU - Transforming data into digital forms - How CPU processes data., machine cycle, MIPS ratings Memory chips-RAM, DRAM, ROM,EPROM chips on the way.

Storage technology

Magnetic tapes, Magnetic Disks, Floppy Disks, Hard disks. RAID (reduced Array of Inexpensive Disks), Optical Disks, CD Roms, WORMs (write once, Read many) Seconday storage-bubble memory, memory cards, smart cards, memory buttons.

Input & output technologies

Input devices - Key board, mice & track balls Digitizing tablets, voice recognition systems, Optical imaging systems, sensors.

Output devices -VDT, CRT, HDTV -Printers, Plotte -audio output device-multimedia systems.

Communication technologies

Communication channels, Fibre-optical cables, microwave &satellite systems - Cellular phones, synchronous & asynchronous transmission modes, communication equipment- Modems, Multiplexers

UNIT-II

(70hrs)

Introduction to LAN, MAN, WAN; a comparative study of PC's and Computer Networks: Introduction to Network topologies, seven layers of OSI model of networking. Introduction to Novell Netware, WindowsNT and Unix (qualitative). A comparative syudy of the features of these systems. Elementary ideas of protocols- TCP/IP, ISDN, Internet, e-mail, websites, information browsing tools. Elementary ideas of Multimedia-sound blaster, video blaster, image processing, morphing, warping etc;

Books

1. Computer Networks -A.S.Tannenbaum
2. Manuals of Novell Netware, WindowsNT &UNIX
3. Internet for Dummies
4. Encylopedia of Multimedia

Practicals (General)

The syllabus prescribed mainly aims at developing experimental skills and ability for data analysis. All experiments are to be considered as serious investigation and as far as possible students should be given opportunity to investigate all possible aspects of the experiments. Use of all measuring instruments should be justified by an error analysis. Evaluation of percentage error in the final result and graph is required.

A course for 4 to 5 hours is to be conducted on theory of errors.

Practical -I Mechanics, Material Properties, Optics and Magnetism

(Minimum of 20 Experiments should be done, selecting at least 2 from expts. given asa group)

1. Study of **Pendulums**-Compound pendulum -symmetric, Compound pendulum - assymetric, Katers Pendulum
2. Study of **elastic properties** of materials
3. Young's Modulus - Uniform bending, Non-uniform bending, cantilever using microscope, telescope etc; **3** Rigidity modulus - Static torsion, torsion pendulum etc;
4. Study of **Viscosity** of liquids i) Stokes method, Poiseulles flow method, Searles Rotation Viscometer etc;
5. **Thermal properties of solids** -Specific heat and thermal conductivity of different materials by different methods
6. **String under tensions** - frequency measurements
7. **Refractive index** of transparent liquids - liquid lens, spectrometer, Newtons rings etc;
8. **Spectrometer** -Dispersive power and Cauchy's Constant, i-d curve, i1-i2 curve, Stokes formula
9. Determination of **wavelength of light** -Spectrometer - Biprism- Newtons rings-
10. **Study of the absorption coefficient** of materials -KMnO4, chlorophyll, iodine, thin film semiconductors
11. Experiments using **He-Ne laser** Determination of the spot size of and divergence Measurement of slit width, Determination of the grating pitch, Determination of λ of laser light
12. **Magnetism** - measurement of magnetic flux (magnet, Earth)-Vibration and deflection magnetometers-circular coil etc;

Practical-II Electricity and Electronics

(Minimum of 20 Experiments should be done, selecting at least 2 from expts. given asa group)

1. Temperature coefficient of resistance- metals , semiconductors
2. Anderson's Bridge - self inductance
3. Conversion and calibration of a galvanometer into a voltmeter and ammeter of different ranges
4. Standardisation of Potentiometer and measurement of emf, resistance, current etc
5. B.G - Hibberts Magnetic Standard , measurement of absolute Capacity, high resistance
6. Study of LCR series and parallel resonant circuits
7. Verification of Network Theorems
8. Construction and study of Diode circuits- Full wave rectifier with and without filter, clippers, clampers and voltage multipliers
9. Design and construction of a regulated power supply using Zener diode, Zener diode and transistor, transistor and IC's
10. Study of Transistor Characteristics - CE and CB of different transistor types- variation with temperature. (Familiarisation of transistor specification sheets is essential)
11. Study of FET - Characteristics
12. Design and construction and study of amplifiers -audio amplifier, power amplifier, power amplifier using IC's and study its characteristics
13. Oscillators- Hartely, Colpitts, crystal oscillators
14. Multivibrators- Monostable and Bistable using IC 555 and 556
15. Experiments using Operational Amplifier -IC 741- inverting and non-inverting amplifier, voltage follower

Practical -III

Part-1 Digital Electronics and Computer Science (minimum 10 expts)

1. Flip-flop circuits using IC 7400 and 7410- study using logic probes
2. Digital counter using 7490
3. A/D converter
4. D/A converter
5. Decoder driven 7 segment display
6. Microprocessor -Data transfer experiments, addition and subtraction, multiplication of two8 bit binary numbers
7. Computers- Develop programs to find the solution of an equation, solve a differential equation, locate some point on a curve using Lagranges method, solve a system of equations.

Part-2 Elective (minimum five expts)

Experiments in Astronomy and Astrophysics

1. Measurement of solar constant
2. Franhaufer lines in the solar spectrum - identification of elements
3. Foucaults Pendulum
4. Measurement of distance to moon
5. Measurement of solar spin
6. Estimation mass of sun
7. Calculation of Red shift and Hubbles constant
8. Construction of an astronomical telescope
9. Construction of a photometer
10. Using photographs estimation of brightness of stars

Experiments in Material Science

1. Young's Modulus- Elliptical fringes
2. Direct shear test on metal rods
3. Hardness testing
4. Operation of a vacuum system to create an ultimate vacuum bettr than 10^{-4}Torr (Demonstration only)
5. Preparation of semi transparent metallic film by vacuum evaporation and measurement of its thickness by optical methods

6. Preparation of a semiconducting film by solution growth technique and measurement of its resistivity
7. Hall effect measurement
8. Estimation of lattice constants of a crystal from XRD spectra
9. Estimation of the optical band gap from the absorption spectrum of a thin film sample
10. Refractive index of a liquid using He-Ne laser

Experiments in Optoelectronics

1. Measurement of wavelength of He-Ne laser
2. Characteristics of a photodiode
3. Characteristics of solar cell
4. Characteristics of LED
5. Measurement of Numerical aperture of optical fibre
6. Measurement of output power from an optical fibre
7. Study of Pulse broadening on optical fibres
8. Construction of a photometer

List of experiments in Radiation Physics

1. Solar constant determination
2. Wind speed measurement and power calculation
3. Characteristics of solar cell and photodiode
4. Measurement of intensity of light using photometer with various filters
5. Acoustic measurement
6. Light intensity variation during evening sky using photometer
7. Humidity measurement
8. Study of the variation of the transmitted intensity of radiation with the thickness of the absorber
9. Study of the variation of the transmitted intensity of radiation as a function of atomic weight of the absorber
10. Determination of the absorption coefficient of different materials

List of experiments in Information Technology

1. Experiment on pulse width modulation and demodulation
2. Frequency modulation and demodulation using PLL
3. Familiarization of Internet tools like Netscape, Internet explorer
4. Internet programming using JAVA

Familiarization of LANs using Novell Netware, WindowsNT and Unix

SEHEME AND SYLLABI FOR SUBSIDIARY SUBJECTS

(PHYSICS AND ELECTRONICS)

SCHEME OF EXAMINATION

		Internal	External	Total	Year
Theory	Paper I	10	50	60	First year
	Paper II	10	50	60	Second Year
	Practical	-	60	60	Second Year
	Record	20	-	20	Second Year
	Total	**40**	**160**	**200**	

DISTRIBUTION OF INTERNAL EVALUATION MARKS

Theory

Class tests	Assignments	Attendance	Total
4	4	2	10

Lab Records

Presentation & Punctuality	Skill	Knowledge	Accuracy	Total
4	8	4	4	20

Pattern Of Question Papers

Each question paper should have four Parts

Part A-Multiple Choice questios	8x1= 8 marks
Part B-Short answer questions	6x2= 12 marks
Part C-Eassy type questions	3x5= 15 marks
Part D- Problems	5x3= 15 marks
Total	**50 marks**

Teaching hours/week

	Theory	Practical	Total
First year	2 hrs	2 hrs	4 hrs
Second year	3 hrs	2 hrs	5 hrs

B.Sc. (PHYSICS) SUBSIDIARY

PAPER-I
Mechanics, Thermal Physics and spectroscopy

Mechanics of a system of particles
Motion of a charged particle in electric field and magnetic field -constrained motion - De Alemberts Principle - Legranges equations - simple applications of Lagranges eqution - Hamiltons Principle, Derivation of Lagranges equations from Hamiltons Principle, Hamiltonian.
Oscillations- Differential equation and solution of S.H. Motion derivation of expressions of the period, velocity and accelerations, phase , initial phase-energy of a particle in S.H. motion - Forced oscillations-Resonance and damped oscillations-composition of two S.H.M.S. along a straight line and at right angles-Lissajous figures-
Behaviour of real gases-gas equation-Andrew's experiments-critical constants-vander Waal's equation reduced equation of state -Joule -Thomson effect - Liquefaction of gases- superfluity of helium.
Thermodynamics-Laws of Thermodynamics- efficiency of Carnot's engine -Refrigerator-Concept of entropy-Maxwell's thermodynamic equations.- change of states -first and second order transitions
Non-conventional energy sources-wind energy, solar energy, solar constant, surface temp of sun (mention only)
Elements of Statistical Mechanics - Phase space - concept of ensembles - M.B, B.E and F.D statistics (no derivation) - comparison amung the three statistics.
Spectroscopy - Vector atom model, Spectra of Hydrogen and Alkali atoms, Term symbols and energy level diagram,Qualitative ideas of Zeeman effect, Stark effect, Faraday effect and Kerr effect.
Rotational and vibrational spectra of diatomic molecules, Band structure of electronic spectra.
Classical and quantum theory of Raman effect, Experimental techniques, discussion of applications
Lasers - Einstein's coefficients, population inversion, Ruby, YAG, He-Ne lasers, Discussion of applications

PAPER - II
Optics, magnetism, Electricity, Electronics and Modern Physics.

Interference. Conditions for interference - coherent sources-Interference due to multiple reflection in thin films-colours of thin films-Newton's rings in reflected light-Determination of wave length-Determination of refractive index of liquid-wedge shaped films- Testing of plainness-Interference filter-Holography.
Diffraction: Diffraction at a straight edge-theory of plane transmission grating-Determination of wave length (Normal incidence) - X-ray diffraction - Braggs' law.
Polarization - polarization by reflection and refraction-Brewster's law-Pile of plates-double refraction-Ordinary and extra ordinary rays-Nicol prism-Principal refractive indices-Quarter and Half wave plates - Elliptically and circularly polarized light-production and analysis of plane polarized light elliptically and circularly polarized light.- polaroids-optical activity.
Magnetism-Magnetic dipole - B-H curve - magnetic hysteresis- Dia, para and Ferro-Magnetism - Curie temperature.
Ballistic galvanometer-logarithmic decrement-experimental determination of absolute capacity of a capacitor.
Varying currents-growth and decay of current in L.R. circuit Time constant-sparking inductive circuit-charge and discharge of a capacitor through a resistance-Measurement of high resistance by leakage-Oscillations produced by an L.C. circuit.
Alternating currents-A.C. circuits containing L C R- (j operator and complex quantity representation) Power factor-Wattles current-choke coil-series and parallel LCR circuits- Calculation of Impedance and current resonance- Q factor-Acceptor and rejecter circuits.
Electronics-Diode circuits and applications-half wave and full wave rectifier- bridge rectifier veneer diode and voltage-regulation-Transistor characteristics-C.E. & CB Transistor as an amplifier and
oscillator positive and negative feed back -multivibrator- Hartley vibrator
Television (Qualitative ideas) Principle of image transmission-scanning-Synchronization-Block diagram of TV receiver -TV Antenna-Micro wave satellite communication.
Quantum Mechanics: Limitations of classical physics (Plank's Law of blackbodyradiation,Photoelectric effect), Matter waves and DeBroglies Hypothesis, Uncertainity principle, Wave packet, Time independant

and time dependant Schrodinger equation, Statistical interpretation of wave function, Normalisation of wave function, Schrodinger equation for a free particle and partice inbox,Basic ideas of quantum mechanical operators.

PHYSICS PRACTICALS (SUBSIDIARY)

List of experiments to be done(minimum 20 experiments)

1. Fly wheel - To determine the moment of Inertia
2. Compound pendulum- Symmetrical - To determine 'g' and radius of gyration.
3. Torsion pendulum- To determine the rigidity modulus of the materials of the wire.
4. Uniform bending- To determine the Young's modulus of the materials of the given bar using microscope.
5. Cantilever- To determine the Young's modulus of the materials of the bar by measuring the angle between the tangents.
6. Static torsion- To determine the rigidity modulus of the materials of the rod.
7. Viscosity- Determination of 'η' by Poiseuille's flow.
8. Lee's disc- Thermal conductivity of a bad conductor.
9. Liquid lens. Determine the refractive index of a liquid and glass.
10. Spectrometer- Solid prism- Determination of refractive index of the materials of the prism.
11. Solid prism- To determine the angle of the prism, angle of minimum deviation and hence calculate the refractive of the materials of the prism.
12. Dispersive - Determination of the dispersive power of the material of the prism by finding refractive indices corresponding to different colors.
13. Diffraction grating- To determine the wavelength of various lines of the mercury spectrum using diffraction grating at normal incidents.
14. Newton's rings- To determine the wavelength of a monochromatic light.
15. Vibration magnetometer- To determine the dipole moment of a given magnet and intensity of Earth's magnetic fields using vibration magnetometer and deflection magnetometer.
16. T.G- To calibrate an ammeter using TG.
17. Calibration of an ammeter- To calibrate the given ammeter using a given potentiometer.
18. Determination of the reduction factor of T G using potentiometer.
19. Calibration of low range voltmeter- To standardize the potentiometer for any low p.d/m and hence calibrate the given low range voltmeter using a secondary circuit.
20. Mirror galvanometer- To determine (a) resistance of the galvanometer by half deflection method (b) current sensitivity and (c) voltage sensitivity of the mirror galvanometer.
21. Conversion of galvanometer into an ammeter and its calibration using standard meters.
22. Conversion of a galvanometer into a voltmeter and its calibration using standard meters.
23. Ballistic galvanometer- To find absolute capacity of the given capacitor
24. P-N Junction diode - To draw the characteristics of the p-n junction diodes , to determine the knee voltage and resistance and to find the break down voltage of a zener diode
25. Junction transistor - To draw the characteristics of C.B.C and C.E.C .
26. Full wave and half wave rectifier- to construct a full wave and a half wave rectifier without filter.
27. AND, OR and NOT gates- Truth tables.
28. Construction of a regulated power supply with zener diode .
29. Construction of a CE -amplifier.

Subsidiary Electronics Paper - 1

UNIT I

Brief history of electronics **(2hrs)**

(As in Microelectronics by Mill man and Grabel)

Introduction to circuit components -Resistors - General information such as symbols, colour code, types, variable resistors, potentiometers. thermistors, LDRs, VDRs, technical specifications like voltage rating. - Capacitors - General informations such as symbols. colour codes, types, fixed and variable capacitors - specifications, voltage rating - Inductors -symbols, types, such as air core iron core , chocking coil, frequency response -Relays -symbols, types - application areas- Microphone & speaker - Frequency response, Impedance, rating, size, Transducers , general ideas about batteries.

(6hrs)

Ref: 1. "Modern electronic equipments" by Khandpur

2." Source book for electronic engineers" by Loveday

Review of band theory Elementary ideas of PN junction diode and transistor physics

(2hrs)

B J T Factors contributing to thermal stability - effect of temperature - stability factor 'S' - Common base stability - collector to base bias - its disadvantages - emitter bias - Voltage divider bias with emitter bias (as in Electronic systems and Devices by Allen Motter Shed)

(5hrs)

AC equivalent circuit- Two Port net work analysis - controlled sources - active circuit models - Transfer impedance - gain in decibels - The trance conductance model - CE,CB,&CC amplifiers, conversion formulas of the 'h' parameters (as in "Electronics fundamentals and applications" by John D Ryder)

(12hrs)

FET biasing - operating point.- fixed bias - self bias - voltage divider bias - depletion MOSFET - enhancement type (as in "Electronic devices and circuit theory" by Robert Boylestad and Louis Nashelske)

(6hrs)

Designing of transistor biasing circuits - Trouble shooting (as in Lab Manual by Zbar)

(4hrs)

UNIT II

Overview of feed back concepts - 4 types of feed back connections - Practical feed back circuits - Phase and frequency considerations (as in " Electronic Devices and Circuit Theory" by Robert boylestad and Louise Nashalske.)

(6hrs)

Power amplifiers: Introduction - definitions - types - series fed class A amplifiers - transformer coupled class A - class B operation - class B circuits - Power transistor heat sinking - class C amplifiers (as in "Electronic Devices &circuit theory by Robert Boylestad and Louise Nashalske)

(8hrs)

Opamp theory - The differential amplifiers - DC analysis - Ac analysis - Schematic diagrams of 741 - opamp parameters - voltage amplifiers - voltage controlled current sources - active filters - active diode circuits - comparators - schmidt trigger - integrator (as in " Semiconductor approximations" by Malvino)

(12hrs)

Electronic analogue computation (as in "Integrated Electronics" by Millman &Halkias) **(3hrs)**

Review of regulators - descrete voltage regulation - improved series regulator circuits- opamp series regulator circuits current limiting - fold back limiting - shunt voltage regulation using transistor and opamp - IC voltage regulators - positive and negative voltage regulators (as in "Electronic Devices and Circuit Theory" by Robert Boylestad and Louise Nashels) **(10hr)**

PAPER II
UNIT I

IC fabrication - Monolithic IC techniques - Planar processes - Bipolar transistor fabrications - Monolithic diodes - resistors - capacitors - IC packaging . (as in " Micro Electronics" by Millman and Grabel)

(10 hrs)

Special devices -Thyristors - the ideal latch - the four layer diode - S C R - variations of SCR - bidirectional thyristor - unijunction transistor - thyristor applications - Schottky diodes - varactor - constant current diodes - step recovery diodes - back diodes - tunnel diodes - varistors. (as in "Electronic Principles" by Malvino)

(8hrs)

T V - picture and sound transmissions and reception - synchronisation - image continuity - scanning - number of scanning lines - flicker - composite video signals - interlaced scanning - fine structure - band width - compatibility - three colour theory - luminance hue and saturation - colour TV camera - luminance signals - colour difference signals. Transistor video amplifier circuirt - guidelines for broad banding - frequency compensation. (as in "Monochrome and colour television" by R R Gulati)

(15hrs)

CRO - CRT - gun - focu ssing and deflection systems - screen - time base - power supply for CRO as (in "Electronic devices and circuits" by G K Mithal)

(5hrs)

Optoelectronics- LED - electroluminescent process - choice of LED materials - light output from LEDs - photo detectors - photo conductors - junction photo diodes - photo transistors - solar cells - hetero junctions - cascaded solar cells - Liquid crystals - physics of liquid crystals LCD - electroluminescence
(as in "Optoelectronics" by Willson & Hawkers).

(10hrs)

Multi stage amplifiers -Frequency response - high frequency tuned amplifier - Q factor - classification - high frequency power amplifier - broad band amplifiers - gain band width trade off - broad banding low frequency compensation - high frequency compensation - inductive peaking (as in "Amplifiers" by Moni)

(10 hrs)

UNIT II

R S flip flops - level clocking - D latches - edge triggered flip flops - edge triggered J K flip flops - Master slave flip flops - buffer registers - shift registers - controlled shift registers - ripple counters - synchronous counters - ring counters - ROMs - PROMs - RAMs - small T T L memory (as in "Digital computer electronics" by Malvino)

(10hrs)

CPU and memory organisation of a digital computer - magnetic core storage - digital recording techniques - I/O units - key board terminals - MICR - OCR - mark sensors

(10hrs)

Ref : "Computer organisation" by Rajaraman

Fortran progamming - Historical back ground of electronic computing - Introduction to levels of computer languages - FORTRAN characters ,constants , words, expressions etc., - arithmetic statements - I/O statements, IF GOTO statements, STOP, END ,PAUSE,RETURN - FORMAT statement DO loop - subscripted variables - sub programmes - sub routine and functions - type declaration statements - Programming at elementary levels (simple problems only)

(25 hrs)

Communication - Optical fibers - Optical transmission techniques - Telephones - modem - E mail

(5hrs)

LIST OF EXPERIMENTS IN ELECTRONICS (SUBSIDIARY)

1.Transistorised multivibrator
2. S.C.R Characteristics
3. Photo diode characteristics
4. L.D.R characteristics
5. TRIAC characteristics
6. OP AMP adder , integrator, differentiator , comparator ,Schmidt trigger , wave form generator
7. FET amplifier
8 . Transistor amplifier with and with out feed back
9. Two stage RC coupled amplifier
10. DC to DC convertor
11. Ripple counter
12. Decade counter
13. Ring counter
14. Shift Register
15. Regulator power supply using IC & Transistor
16. 555 IC astable and mono stable operation
17. Differential amplifier
18. Verification of operation of a JK flip flop
19. Verification of De Morgan's theorem.
20. Emitter follower.
21. Fortran programming (simple problems)

MODEL 2

B.Sc. Physics (Vocational)

Introduction

B.Sc. Physics (Vocational) is a course intended to be a parallel under graduate programme with the following aims and objectives

1. It aims at preparing the university graduate for immediate employment.
2. It also aims at developing the capabilities which will enablethe graduate to set up their won small enterprises with support from the nationalised banks and other financial institutions.
3. It emphasizes on the development of the enterprencuriall capabilities among the graduates.
4. It developes the learner's competence by evolving a learner centred curriculum.
5. As this course provides an 'on-the-job training' session during the vacation, a student may acquire sufficient experience and operational skills in the chosen discipline.
6. The practical work a student performs need not be merely a supportive of the theoretical lessons he/she leanrs, but it should aim at the development of his/her manual and mental skills promoting vocational competencies (Read UGC Report on vocationalization September 93 Section V-45). For instance, a student opting for a course in electronic instrumentation should be able to undertake repair and maintenance of the common electronic gadgets now in use.
7. Although vocational subjects are terminal in nature, emphasizing transmission of knowledge and skills required for specific jobs, a student choosing a particular vocational subject should not loose his/her chance of undertaking a post graduate course in the core subject.
8. As this course does not curtail either the academic standard or the content of the B.Sc.Physics course, it does not prevent the vertical academic rise of a graduate. He can continue his studies at a post-graduate level in the core subject (Physics) and if the law permits even in the vocational subject he chooses viz; computer applications, instrumentation etc. (Read-Report of the committee constituted by UGC on vocationalization of degree education-September '93 Section V.42.)

On-the-jobTraining

Apart from the knowledge he/she may acquire from the classroom, library and laboratory facilities available in an institution, he/she should be guided to get enrolled in any recognised fim/factory/laboratory outside institution in the locality for obtaining the necessary on-the-job training in the chosen vocational discipline. Furthehr he/she may be advised to take up assignments/jobs under the supervision of qualified personnel. On-the-job training is an essential part of the proposed curriculum. It should be provided during the vacation between the second and third semester and between the fourth and fifth semester for a total period of two months. The student must produce a certified report of the job training he/she has undertaken and this must be evaluated internally. The apprenticeship training act, a student performs in any recognised form or institution may fetch for him a stipend from that particular firm/institution.

Project work

The project work is an essential part of the course. The student are expected to take up assignments/projects on their own and to complete them in a stipulated time under the supervision of an expert personnel. It is aimed at the development of the innovative skill of the student. It generates necessary skill in him/her to solve a paarticular problem. The project should be innovative, research oriented and related to the chosen vocational/core subject with a specified standard. It should be evaluated externally.

Successful Implementation.

Two most important pre-requisites for the successful implementation of this course would be faculty training and laboratory expansion. At least two junior members of the faculty must be trained under the supervision of the University in recognised firms for a period not less than two months. In this regard, the university should take the initiative to establish a central laboratory for the benefit of the surrounding

colleges with the financial assistance from the UGC. Financial support will have to be provided to the colleges to equip their laboratory to suit to the specified requirements.

Evaluation

Timely and periodic evaluation is an important part of the course. Any failure in the proper and timely evaluation process would hinder the smooth and effective monitoring of the course designed to work in the semester system. The university should take necessary steps to smooth and timely conduct of the examinations. Internal evaluation of the theory paper should be continuous and transparent. A student must obtain a specified percentage of the average marks he scores in the pepriodical/monthly tests, assignments etc.

Further proposals

The workshop for the Physics teachers on the course restructuring held at the School of Pure & Applied Physics, M.G. University from 8th to 12th December 1997 put forward the following proposals to the university for consideration.

1. The language component compulsorily introducted in the B.Sc. (Vocational) curriculum should be reduced and the hours saved must be effectively used to the study of history and philosophy of science. This will surely enlighten the spirit and enthusiasm of students opting for the proposed course. Further it will enrich the culture and the art of science which would inculcate values in the students. This will lead them tomorrow's technologies with more values.

2. The University should steer its machinery for the effective and smooth conduct of the examinations and should take necessary steps to bring out the results of the examination on a time bound basis.

COURSE STRUCTURE

Name of the course : B. Sc. Physics (Vocational)
Duration : 6 semesters of 15 weeks each

UNITWISE BREAKUP

Subject	Number of Papers Theory	Practical	Total	No. of Hours	% of Work Load
Part I - First language - English	4	---	4	20	13.3
Part II - Second language	2	---	2	10	6.7
Part III - Unit -I - Core Subject - Physics	10	2	12	60	40
Unit -II- Vocational Subject (any one)	8 10	2		40	26.7
Unit - III- Complementary Subject- Maths	4 4	---		20	13.3

Unit-I Core Subject

The core subject of study shall be Physics. The study of Physics shall consists of ten theory papers two practical papers including lab records and Viva-Voce.

Unit - II Vocational Subject

The vocational subject may be selected from the list given above. It is organically related to the core subject (Physics). It contains in addition to the theoretical and practical components, on-the-job training and project report components. On-the-job training shall be organized in recognised firms for total period of 4 weeks between 2nd and 3rd semesters and between 4th and 5th semesters. The study of the Vocational Subject shall consists of eight theory papers, two practical papers including lab records, project report and report on-the-job training.

Vocational subjects proposed are:

1. Instrumentation
2. Engineering Physics
3. Electronic equipment maintenance
4. Computer applications
5. Computer system management.

Unit-III Complementory subject

The compelmentory subject is mathematics. It shall contain four theory papers. The syllabus prescribed is the same as that of the subsidiary Mathematics meant for model 1.

Semesterwise distribution of (core) Physics papers

Paper		Title of the paper	Semester
Theory	I	Basic electronics and electricity -Unit I	Sem I
	II	do -Unit II	Sem II
	III	Optics and Spectroscopy -Unit I	Sem III
	IV	do -Unit II	Sem III
	V	Mechanics -Unit I	Sem IV
	VI	do -Unit II	Sem IV
	VII	Solid State and Nuclear Physics - Unit I	Sem V
	VIII	do -Unit II	Sem V
	IX	Digital Electronics & Computer Science - Unit-I	Sem VI
	X	do - Unit II	Sem VI
Practical	I	Mechanics, Material Properties, Magnetism&Optics	Sem III
	II	Electricity, Electronics & Computer Science	Sem VI

Syllabus prescribed for Model I (B.Sc Physics) excluding the elctive paper is employed here.

Table showing semesterwise examination and mark distribution is given below

Semester	Examination		Marks		
			Internal	External	Total
Sem I	English	Paper I	10	40	50
	II Language	Paper I	10	40	50
	Physics	Paper I	5	30	35
	Vocational	Paper I	5	30	35
	Mathematics	Paper I	10	40	50
Sem II	English	Paper II	10	40	50
	II Language	Paper II	10	40	50
	Physics	Paper II	5	30	35
	Vocational	Paper II	5	30	35
	Mathematics	Paper II	10	40	50
Sem III	English	Paper III	10	40	50
	Physics	Paper III	5	30	35
	Physics	Paper IV	5	30	35
	Vocational	Paper III	5	30	35
	Mathematics	Paper III	10	40	50
	Physics	Practical I	10	40	50
	Vocational	Practical I	10	40	50
	Physics	Record I	10	-	10
	Vocational	Record I	10	-	10
Sem IV	English	Paper IV	10	40	50
	Physics	Paper V	5	30	35
	Physics	Paper VI	5	30	35
	Vocational	Paper IV	5	30	35
	Mathematics	Paper IV	10	40	50
Sem V	Physics	Paper VII	5	30	35
	Physics	Paper VIII	5	30	35
	Vocational	Paper V	5	30	35
	Vocational	Paper VI	5	30	35
Sem VI	Physics	Paper IX	5	30	35
	Physics	Paper X	5	30	35
	Physics	Practical II	10	40	50
	Physics	Record II	10	-	10
	Vocational	Paper VII	5	30	35
	Vocational	Paper VIII	5	30	35
	Vocational	Practical II	10	40	50
	Vocational	Record II	10	-	10
		Project Report	-	50	50
	Vocational	On the job training report	30	-	30
	Viva-voce		-	50	50
Total			300	1200	1500

Internal Evaluation

20% of the total marks (ie., 20×1500/100=300) is awarded internally. The split up is given below

i)Theory Papers

Attendance	Assignment /Seminar	Tests	Total
1	2	2	5
2	4	4	10

ii) Lab Records

Presentation & Punctuality	Skill	Knowledge	Accuracy	Total
2	4	2	2	10

Scheme of Work and Examination

Year	Semester	Teaching hours per week								No. of examination papers at the end of semester							
		Physics		Vocational		Maths	Eng	II Lang	Seminar	Physics		Vocational		Maths	English	II Language	Project
		Th	Pr	Th	Pr					Th	Pr	Th	Pr				
I	I	3	2	3	2	5	5	5		1		1		1	1	1	
	II	3	2	3	2	5	5	5		1		1		1	1	1	
II	III	8	2	3	2	5	5			2	1	1	1	1	1		
	IV	8	2	3	2	5	5			2		1		1	1		
III	V	10	4	8	2				1	2		2					
	VI	10	4	8	2				1	2	1	2	1				1

SYLLABI OF VOCATIONAL SUBJECTS

1.INSTRUMENTATION

PAPER - I

Instrument Mechanisms **(45hrs)**

Introduction. Materials for instruments; bearings; machine bearings vs. instrument bearings. Different types of bearings and guides. Locks and stops - Locks, unidirectional locks, stops, stops for linear motion, switching stops- stops for rotary motion. Couplings-Rigid couplings, couplings for shafts with longitudinal shift, coupling for shafts with off of centres, coupling for shafts with angular misalignment, flexible couplings. Clutches -Claw clutches, friction clutches, clutch engaging devices, special clutches, torque limiting clutches, centrifugal clutches, over running clutches, single revolution clutch, clutches with permanent magnets. Energy storing elements: Mass springs, leaf springs, spiral springs, torsion springs, conical disc springs.

Functional Mechanisms: Gear mechanisms, friction wheel mechanisms, wedge and screw mechanisms, linkage mechanisms, integrating mechanisms, differential quantity integrator, rate quantity integrator. Elements in high speed mechanisms: inertia, friction and energy. Elements of workshop technology: (covering fundamentals of simple manufacturing processes machines tools like lathes, drilling machines, milling machines, shaping machines, metal forming and casting).

Books

1. Elements of Precision Engineering, R. Raman, Oxford & IBH Publishing Co., New Delhi - Bombay - Calcutta.
2. The Design and use of Instruments and Accurate Mechanism, White head, T.N., Dawn Publication Inc.

PAPER - II

Metrology **(45hrs)**

Measuring systems and precision instruments. Measuring with rules. Mathematical concepts. Limiting mean, range, variance. Standard deviation, normal distribution, confidence intervals. Principles of sampling. Standards of measurements. Standards of length, end standards. Vernier Calipers, fixed gauges, inside, depth and height gauges. Gauge blocks surface plates, micrometers. Angular measurement, sine bars angle gauges levels, clinometers, auto-collimators, taper gauges. Direct measuring tools and instruments. Optical projectors and microcopes. Horizontal, vertical can cabinet profile projectors. Tool makers and workshop microscopes. End standards end bars, slip gauges.

Comparison measurements: Comparators, pnuematic, electric and electronic comparators. Limits, Fits and Tolerances. Interchangeability, types of fits, geometric dimensioning and tolerance. Interference. Surface characteristics, Evaluation and symbology. Surface roughness measurements, profilometers.

Alignment testing. Machine tools alignment, machine beds, Alignment of axis (spindle axis and bed, spindle axis and line of centers), axial slip and calibration of lead screw, alignment telescopes. Interferometers. Ultrasonic pulse - Echo and resonance guaging, optical alignment. Equipment and methods. Surface texture measurements and guaging. Testing of screw threads. Pitch and angle error. External and internal thread guages. Testing of gears, involute geometry, runout, pitch, profile, lead, backlash, tooth thickness, roundness measurements, lobing of cylinders. Management of inspection and quality control. Automatic dimensional controls manufacturing processes.

Books

Engineering Metrology. R.K. Jain. Kanna Publishers Delhi 1973

Paper - III

Mechanical Measurements **(45hrs)**

Introduction - Types and applications of measurement. Instrumentation - Configuration of measuring instruments - Static and dynamic performance .Characteristics of instruments - Analysis of experimental data. Measurement of displacement, Area and velocity (electrical and mechanical methods, planimeters, stroboscopes, revolution counters, tachometers). Measurement of force, safe power and strain (strain guage, differential transformer and piezoelectric types of transducers, dynamometers).

Measurement of pressure (dead weight guages, manometers, electrical pressure pickups, Borden tupes, high pressure measurement low pressure (vacuum measurement). Measurement of sound (sound level meter microphones). Measurement of flow (pitor - static probes, venturi, orifice and nozzles, rotameters, vane, hot sphere, hot wire, hot-film anemometers, ultrasonic techniques). Measurement of temperature and heat flux (thermocouples, resistance thermometry radiation thermometry, heat flux sensors). Miscellaneous measurements (Time, frequency, phase angle, vibration instruments noise measurements, liquid level, humidity, chemical composition).

Books

1. Doeblin, E.U., Measurement Systems - Application and Design- Mc Graw Hill, 1975.
2. O'Hiccin, P.J., Basic Instrumentation, Mc Graw Hill, 1966

PAPER - IV

Vacuum instrumentation **(45hrs)**

Introduction to vacuum - fundamentals Gas flow mechanisms, conductance calculations, concept of throughput and pumping speed. Rotary, and oil free pumps Diffusion pumps Turbo molecular pumps. Pressure measurement by thermal conductivity and ionisation gauges. Gauge calibration using spinning Mcleod gauges. Vacuum components - traps, baffles, valves, seals and feed-throughs. Vacuum materials and fabrication techniques-

Leak detection techniques, Mass spectrometer and residual gas analysis. High vacuum systems design. Thin film deposition techniques - thermal evaporation and modifications. Sputtering technique - various modifications- advantages and limitations. Film thickness - measurement and monitoring. Vacuum applications - Freeze drying, Food processing industry, lamp industry, Vacuum metallurgy, vacuum impregnation.

Books

1. Introduction to the theory and practice of High Vacuum Technology, L. Ward and J.P. Bunn,Butterworths, London.
2. Vacuum Technology, A. Guthrie, John Wiley and Sons.
3. Vacuum Deposition of Thin films, L. Holland, Chapman and Hall.
4. Moder Vacuum Practice, Nigel Harris, McGraw-Hill.

PAPER - V

Optical Instrumentation **(60hrs)**

Optical components and their characteristics: Plane mirrors, Achromatic prisms, Direct Vision prisms, Right angle prisms, roof prisms, erecting prism systems, cube corner prisms, beam splitter cubes,. curved mirrors, lenses, ophthalmic lenses. Optical materials and fabrication techniques: Optical glasses and their characteristics, crystalline materials. Optical machiner: Grinding, polishing, drilling, trepanning, spherical curve generator, optical tools, abrasives and materials. Making optical components: Flats, mirrors, parallel plates, mirrors, lenses, prisms, polishing crystals. Testing optical components: Newton's interferoscope, Fizeau interferometer, Multiple beam interferometer, Fabry-perot interferometer, polarization interferometer. Autocollimators, Rochi grating test, Foucault knife edge test. Haitmann and other screen tests. Distance measuring interferometers. Bull testing comparators.

Fibre optics - Principles of optical fibres. Materials for optical fibres. Production of optical fibres, sources, detectors, couplings. Applications of fibre optics - illuminators, imaging bundle, endoscopy, communications, fibre optic sensors.

Optical instruments: Compound microscopes, binocular microscope, projection microscope, Binoculars, Telescopes - terrestrial and astronomic, profile projectors.

Laser instrumentation: Principles of lasers, construction of the laser. Applications in distance measurement, interferometry and holography.

Books

1. Fundamentals of optics, Jenkins and White, McGraw Hill, 1957.
2. Optics and Optical Instruments, Johnson, Dover, N.Y. 1960.
3. Optical glass working, Twyman, Hilger and Watts, London 1955.
4. Optical shop testing, Daniel Malacara, John Wiley and Sons, New York 1978.
5. Optics and Atomic Physics, Satyaprakash.
6. Applied optics - R. King's slake

PAPER - VI

Microprocessors **(60hrs)**

Introduction: What is a microprocessor. Need of microprocessor in Instrumentation. Advantages of microprocessor based instrumentation over conventional instrumentation.

Review of digital electronics- shift registers, counters, decoders and encoders. Tristate Buffer and multiplexed display systems. Microprocessor Architecture Memory organisation: Types of memories (RAM, EPROM, ROM, PROM, DRAM). Basic concept's of memory organisation (Number of address lines required, arrangement of memory cells, control lines, memory extension). Concept of control lines such as Read/Write chip enable. Register to Register transfer via Data bus. Arithmetic and Logic Unit (ALU). Design of a small ALU. An ALU which performs four basic (4 bit) operations (ADD, SUBT, OR, AND). Need for Instruction Decoder. Integration of ID with ALU to form an ALU with control signals. Control and Timing Unit: Need for this unit, concept of sequence of execution of an Instruction. Detail design of control unit. Integration of all components to form C.P.U.. Introduction to 8085 Architecture Block diagram, Address Bus, Control Bus, Data Bus, need to multiplex address and data bus. Memory organisation with emphasis on demultiplexing address and data bus during memory read to memory write. Control and timing unit. ALU details. Registers, Flags, memory mapped I/C and I/O mapped I/O.

Instruction Set Introduction, classification of instruction set, opcode format some basic instructions Data transfer instructions, this must include (a) Immediate Addressing (b) Register Addressing (c) Direct addressing (d) Indirect addressing. (ii) Arithmetic and Logic Instructions. Add, Sub, AND, CR MRO, CMP. Control and Timing Sequence of execution of Instructions. Concept of Instruction cycle and machine cycle. Various types of machine cycles along with associated control and status signals (Opcode fetch, memory read, memory write, I/O Read, I/O write, IO/M, SO, S1, MR, MW/Detail timing diagram of some Instructions. Advanced Instruction Branching, conditional and unconditional concept of stack, need for stack pointer. Interfacing Concept of Interrupts, classification of interrupts, various types of Interrupts. Software interrupts RSTO, to RST7. Instructions associated with interrupts (RIM, SIM, EI, DI) Typical Examples illustrating usage. Interfacing with peripherals Concept of Input and output ports. Study of 8255, 8279, 8253 (General description, how to program, usage) Interfacing of A/D and D/A converters.

Books

1. Microprocessor Architecture, Programming and Applications - Gaonkar.
2. Digital Computer Electronics - Albert Paul Malvino (TMH, 1/e)
3. Microprocessor's and Applications - Mathur.

Paper - VII

Transducer's and signal conditioners **(60hrs)**

Introduction: Basic concepts of measurement. System configuration (generalised). Problem analysis (Minimum performance required etc). Basic characteristics of measuring devices such as accuracy, precision, error, intrinsic absolute and relative errors, uncertainty and random errors, Systematic and Instrumental error, interference errors, installation errors, operational errors (human errors).

Transducer classification: Definition, classification (active-passive), classification of electrical transducers, dimensional relationship such as force with density, stress etc. Basic requirements of a transducer (ruggedness, linearity). Explain static and dynamic response.

Instrumentation system: Zero order, First order, Second order systems - dead time element specification and testing of dynamic response. Signal generation and processing. Sine wave generation and amplitude stability, linear frequency control and quadrature output. Sawtooth wave (linear), square wave generator. Stair case generator. Signal conditioners: Instrumentation amplifiers, characteristics, linearisation, D.C. amplifiers, amplitude modulation, frequency modulation, pulse width modulators. Emphasis on phase sensitive detectors and their importance in extracting signals burried under noise. Precision rectifiers, peak detectors, sample and hold circuits (aperture time acquisition time etc.). comparators and qualitative importance of logarithmic amplifiers. Isolation amplifiers, optical isolators. Reference voltage and current. Filters: Passive and active filters, types of filter: first order and second order, low pass, high pass, band pass, band reject, and their frequency and phase response. (For higher order filters qualitative explanations if not mathematical). Analogue to digital and digital to analogue conversion: Display systems: LED, LCD, SEVEN SEGMENT, CRT, DOT MATRIX Transducers (only selected ones to describe complete instrumentation system) Temperature: Thermocouple, platinum resistance thermistor. Strain guages- Different bridge configurations (Wheatstone, Quarter Bridge, half bridge, full bridge) Methods of balancing. One typical load cell example. LVDT for displacement or acceleration measurement full details. Hall effect devices: and change Amplifiers Pressure: Solid State Devices Piezo-resistance Piesojunction

Books

1. Instrumentation Devices and Systems by Rangan, Mani & Sharma.
2. Electronic Measurement and Instrumentation by Oliver & Cage.
3. Electronic Instrumentation and Measuring Techniques. by Cooper.

PAPER - VIII

Instrumentation Systems **(60hrs)**

Analytical Instrumentation: Introduction to instrumentation system; need for an integrated approach. Analytical instruments: Working principles, operation and data analysis of the following instrument: spectrophotometers, atomic AAS, electron microscopes. Nuclear Magnetic Resonance spectrometer. Principle of operation, sample preparation and data analysis; stability of magnetic fields and electronics. Mass spectrometer: Application areas, working principles of static and dynamic instruments, analysis of data. X-ray techniques and their application to radiography, fluorescence and diffractometry. Interpretation of data. Biomedical Instrumentation: Introduction to transducers and their application, recording electrodes. EEG, ECG and other potentials: Working principles and precuation. Blood pressure measurements, introduction to thermodynamics. Introduction to ultrasound and tomographic techniques. Interpretation of data and precaution for measurements. Introduction to working principles and operation of pacemakers, defibrillators, heart-lung and other ICU instrumentation. Environmental Instrumentation: General introduction to physical environment: Physical aspects like, pressure, temperature, humidity, noise, visibility, air quality and water quality. Hygrometers and dew point instruments, controlled humidity environment. Thermal comfort meter, heat stress monitor, and temperature monitors. Hot-wire anemometer, ridar. Sound level meters, tape recorders, noise dosimeters, sound level monitors and acoustical calibrators. Solar flux, pyranometers and pyrheliometers. Water quality by Turbidity meter, calorimeter, pH meter, microscopes, atomic absorption spectroscopy. Air quality measurement using gas chromotography, high pressure liquid chromotography, gas chromotography, conductivity meter. Particulate matter in air, soiling index and visibility. Congenial environment for work, artificial lighting acoustic consideration and air conditioning.

Books

1. Air pollution - Physical and chemical fundamentals- J.H. Seinfeld. MgGrawhil NY 1975.
2. Meteorological Instruments - W.E. Knowled Middleton and A.F. Spilhans, University Toronto Press 1953.
3. Instrumental methods of Analysis -William, L.L. Merrit, J.A. Dean, F.A. Settle(6/e) .
4. Environmental Instrumentation - Frichtschen, L.J. and Gay, L.W.
5. Thermal comfort - Fanger, Robert E. Krieger Publishing Company, Malabar,

PRACTICALS

Instrumentation Drawing (minimum five expts to be designed from the following)

Conventional representation of common elements of instruments. external and internal threads, slotted head, square and flat, bearings (ball and rollers), compression springs with square and circular sections, springs.
Gears: Helical gears, screw gears, rack and pinion, bevel gears (assembly), worm and worm wheel.
Geometric drawing, orthographic projections, sections pictorial drawings.
Proportionate sketch and isometric views of the following instruments.
Voltmeters, single phase energy meters, ammeters.
Draft and pressure measuring devices, flow meters
I.S.A. symbol for instrumentation flow plan.

Experiments in metrology (minimum five expts to be designed from the following)

Experiments to familiarise the use of instruments and techniques for measurement - double ended plug gauge, micrometer calibration, taper plug gauge,, sine bar.
Experiments to familiarise the use of instruments and techniques for measurement of temperature, flow, pressure, torque, strain, vibration and noise.
Three-pin regulators (+Ve and -Ve regulators)
Check the regulation (Line and load regulations)
Main's stabiliser - for home

Experiments in Optics (minimum five expts)

1. Optical fabrication: grinding and polishing a plane parallel plate.
2. Image formation using lenses and lens combinations.
3. Building a refracting telescope.
4. Testing concave mirrors using the Foucault Knife edge test.
5. Abbe refractometer - measurement of refractive index.
6. Interference fringes - Young's double slit experiment-and Fresnel's biprism.
7. Testing the flatness of plates using the Newton's interferoscope.
8. Familiarization of holograms.

Experiments in Vacuum Technology (minimum five expts)

1. Servicing of rotary pump.
2. Conductance and speed of the rotary pump at the vessel.
3. Working of U tube manometers and Mcleod gauge.
4. Secondary gauges like Pirani, Penning and calibration of gauges.
5. High vacuum pumps and measurement of high vacuum.
6. Design of a high vacuum system - a case study.
7. Vacuum evaporation and preparation of a mirror.
8. Leak detection techniques.

Transducers and signal generators (minimum five expts)

1. Practicals in Op-Amp: Inverting, Non-inverting, Buffer, Offset Balance.
2. Sine wave and Square wave Generators (Amplitude stability)
3. Filters: Low pass, High pass, Band pass, All pass filters.
4. Transducers: (Exp. set up)

(i) Strain guage
(ii) LVDT
(iii) Load Cell
(iv) Thermistor or Diode as Temperature sensor
(v) Hall effect transducer.

2. Engineering Physics

PAPER -I
Electrical Engineering Physics-1

Electrical Circuit Theory **(45hrs)**

Network theorms and applications—Transient & steady state analysis of electrical circuits—Resonant circuits—Coupled circuits—Balanced three phase circuit—Network parameters—Elements of network synthesis—Active filters.

Measurement & Intrumentation

Electrical standards—Error analysis—Measurement of current, voltage, power, energy, power factor, resistance, inductance, capacitance, frequency and loss angle. –indicating instruments , Electronic multimeter CRO frequency counter, digital voltmeter, Q-meter, spectrum analyzer, distortion meter. Transducers—thermocouples, thermistor, strain gauges, piezo-electric crystals.

PAPER-II
Electrical Engineering Physics- 2

Electrical Machines **(45hrs)**

Mechanism of torque production in rotating machines, DC Machines—Generator characteristics, dc-generators and dc motors—torque equation—Motor characteristics, Applications. Synchronous machines—synchronous generators emf equations synchronous motors—torque production—Induction machines. Performance, characteristics and analysis—equivalent circuits—starters and speed control. Power transformers: Two winding and three winding. Classification—Performance analysis—Equivalent circuits—Regulation and efficiency—Parallel operation—Autotransformer.

Books:

1. Classical Electrodynamics- Jackson
2. Signals and systems - Roy Choudhury, Wiley Eeastern Ltd
3. Electrical machinery - P.S. Bimbhra, Khanna Publishers.
4. Instrumentation devices and systems - C.S. Rangan, G.R.Sarma and V.S.V. Mani.Tata McGraw Hill, New Delhi, 1983
5. Measurement Systems-Application and design- McGraw Hill, 1985

PAPER -III
Electronic Engineering Physics -1

Communication Systems **(45hrs)**

Generation and detection of amplitude, frequency, phase and pulse modulated signals—Comparison of different systems of modulation—noise problems—channel efficiency—sampling theorems—transmitting and receiving systems. antennas and feeders—transmission line at audio, radio and ultra- high frequencies. Fiber optics and optical fiber communications systems. Digital communication—pulse code modulation—Multiplexing—Data communication—computer communication systems—LAN—WAN and Internet. Satellite communication—Radar and Navigation

PAPER -IV
Electronic Engineering Physics- 2

Wave guides **(45hrs)**

Waves in a guided media—cavity resonators—microwave tubes-- Klystron and TWT. Solid state microwave devices-microwave amplifiers-micro-wave receivers. Microwave filters and measurements-Microwave antennas.

Industrial Electronics

Thyristors Controlled rectifiers-Single phase and poly phase rectifier circuit -smoothing filters-Regulated power supplies- Choppers- Inverters- Cyclo converters -Applications to variable-Speed drivers-(Induction and dielectric heating). Timers-

Books

1. Introduction to the principles of communication theory- Hancock
2. Modern digital electronics- Jain
3. Modern Electronic equipment- Khandpur
4. Industrial Electronics-Morris
5. Semi conductor circuit-Approximation- Malvino
6. Thyristor Control of electric devices- Subramanian

Paper -V
Analytical Engineering - 1

Non-destructive testing **(60hrs)**

Flaw detection by X-ray analysis-Hardness and tensile strength of materials. Measuring instruments-units.Thermal analysis of materials -Gravimetric and Calorimetric methods-spectral studies and chemical identification. Advanced analytical instruments-XRD, XRF,IR , FTIR-Atomic absorption. Various types of magnetic materials and applications-Hall effect Ultrasound testing instruments-sono gram -magnetic resonance imaging-techniques.

Environmental Engineering

Estimation of water resources -productivity demand of water-impurities of water and their significance-physical, chemical and bacteriological analysis of water born diseases-standards of portable water. Environment Pollution- Air and Water pollution-Sound Pollution-Ecological balance - radioactive waste and disposal -rural sanitation.

Books:

1. Air pollution by C.S. Arthur
2. Instrumentation for control and automation for water - waste water treatment systems by J. F. Andrew, P. Briggs and S.H. Jankins.

PAPER - VI
Renewable Energy

Renewable energy **(60hrs)**

Estimation of energy consumption in a country-energy crisis-and management. Renewable and non-renewable energy sources - importance of renewable sources. Wind energy: Wind Velocity and wind power selection of sites-wind mills -different forms of wind mills-efficiency-estimation of wind energy potential. Ocean energy: Ocean thermal energy conversion systems (OTEC).Wave energy-various models of wave energy conversion systems-Estimation of wave energy potential and site identification. Tide energy-Estimation of tide energy potential-draw backs-models. Geothermal energy: Hot springs and geothermal energy-geothermal energy conversion.

Books

Renewable Energy Sources- John M.Twidell, Anthony D. Weir, ELBD Edn 1987
Renewable Energy Sources- Maheswar Dayal

Paper - VII
BIO MEDICAL ENGINEERING - 1

(60hrs)

Introduction

Brief review of human physiology and anatomy-diagnosis and treatment- biopotentials-electrophysiology-electrodes and transducers and their characteristics-modern diagnosis and treatment. Bio medical electronics and electrodes-iosignal- need for low noise pre- amplifier- difference amplifiers- chopper

amplifiers- Different types of electrodes- equivalent circiuts of microelectrodes-electrical saefty. Bio-potential recording-ECG, EEG, EMG, ERG, PCG, EOG- Lead systems and recording methods- typical waveforms- frequency spectrum- abnormalwaveforms-evoked response.

PAPER - VIII
BIO MEDICAL ENGINEERING -2

(60hrs)

Non electrical physiological parameters measurements-Blood flow-systolic and diastolic pressure-automatic measurement-respiration rate- phonocardiogram measurements of concentration of CO_2 and O_2 in exhaust air and blood- pH of blood- ESR and GSR- temperature- spirometer- BMR apparatus-electrophoresis

Therapeutic instrumentation-Biological simulators-defibrillation radiation and physical therapy- prostheses devices and orthopedics - artificial kidney and heart lung prostheses- laser and ultra sonics in medicine-Telemeasurement and telesimulation of various biological parameters-need -future trend

Books

1. Biomnedical instrumnetation- Lesli Gromwell ; Prentice Hall NJ 1980
2. Medicine and Clinical Engineering- B.Jackobson and J.GWebster; PHI New Delhi 1979
3. Hand Book of Biomedical Instrumentation R.S.Khandpur; TMH 1987
4. Biomedical Telemetering Mackay StuartWiley NY 1970
5. Therapeutic Medical Devices M.C.Albert and j.G.Webster;Printice Hall NJ.1982

Engineering Physics : Laboratory Experiments [Any 10 experimnets]

1. O.C.C of D.C generator
2. Speed Control of D.C. motorOC test and Sc test of Transformer
3. Electrical resistivity measurement
4. Tension test
5. Torsion test
6. Hardness test
7. Viscosity determination of a fluid
8. Amplifiers-different types-design and perfomance analysis
9. Operational Amplifiers
10 Controls usinf Triac,diac,powertransistors etc
11. Active filters using O-Amps
12. 555 Circits, Phase locked loop
13. Binary adder/substractor
14 Digital Comparator
15 Shift registers
16.Counters
17.IC Timers
18.Ecoders and Decoders

3.COMPUTER APPLICATIONS

PAPER - I

Computer Fundamentals

(45hrs)

What is a computer–an introduction. Uses of computers in modern society e.g. weather forecasting, census, oil exploration, speech recognition, banking, publishing, accounting, research etc.

Information concepts and processing–evolution of information processing–data, information, language and communication.

Computer arithmetic and number systems-binary and hexadecimal. ASCII & EBCDIC character sets. Elements of a computer processing system–hardware software–computer capabilities and limitations.

Concept of files and directories,familirization of DOS. Hardware features and use–CPU, I/0 devices. Storage devices and media.
Introduction to networking, Multiprocessing, time sharing, multitasking and real time computing.
Variety of hardware systems and features. Various types of computers available in market. Micro, Mini and main frames. Supercomputers.

Practical
Visit to computer lab.
Introduction to various components of a computer.
A simple documentation preparation and printing. Usage of printer and other components.
Introduction to word processing.

PAPER-II

Introduction to IBM PC
(45hrs)
Evolution of personnel computers. IBM PC. Basic block diagram of computer. Difference between personnel and main frames–Simple operating system, Easy to use, Less memory, Dedicated, Normally single user.
Introduction to microprocessors and associated components. Timers, display controllers, DMA controllers (introductory and block diagrams only). Block diagram of IBM PC. Introduction to 8086 and 8088. Functional description of various modules and cards (special reference to 486 and Pentium), 386, mother board, co-processor. Boot process in IBM PC. System files. Self test.
Various types of displays and other peripherals used in IBM PCs. Identification of different VDUs, Key boards, Printers, Scanners, Introduction to display adaptors. Disk Operating System–introduction. Batch files. Config. files. COM, EXE, SYS, BIN and TXT files. Introduction to programming in BASIC. Development of programs in QBASIC. Use of graphics facilities using Basic. Use of HELP in DOS. Diagnostics for IBM PC. Use of Norton utilities and other packages for undeleting a file and other system maintenance jobs. Advanced version of IBM PCs and compatibles- adaptation of modem in an advanced PC.

Practicals
Physical inspection of IBM PC and internal cards.
Introduction to nomenclature (com 1, com 2 etc.).
Writing batch files for various purposes. Modifying config. sys files.
Creating RAM Disk.
Diagnostics on IBM PC.
Controlling PC hardware using Basic programs.

PAPER - III

Operating Systems **(45hrs)**
Introduction to various categories of software's. Operating system and its functions. Interaction of operating system with hardware and user programs. Various components of operating system with reference to DOS. Lenex Single user operating system. Task loader. Memory management, Use of memory, use of config.sys, use of hemem.sys. File management Directory structure in DOS. Moving, renaming, copying deleting and undeleting files under DOS,Tree.com. Device Management. Control of various devices. Device drivers. Interrupt driven and poll driven data transfers. Need of software

and hardware protocols. BIOS. DOS. DOS internal and external commands. Use of DOS commands. Taking and restoring backups. BIOS and DOS interrupts, understanding error messages. Multiuser, multitasking, multiprocessing and real time operating systems. Introduction to Memory management techniques. File systems. File management. Process management and scheduling. Special requirements and facilities for multiprocessing environment.
Networking, Dedicated and non dedicated servers, Installation of LAN, Novel devices, T clamp, cable, cards. Practical knowledge of Windows NT, Oracle. Examples of multiprocessing operating systems. Introduction to Unix. User Management in Unix. Unix commands. Introduction to Internet and Electronic mailing.

Practicals
Development of a batch file to install a software from floppy to disk.
Development of a batch file to manage various packages on the disk.
Detection of viruses and protection on IBM PC.
Using shell scripts for elementary data processing.
Creation of shell script to manage disk quota on a unix system.
Creation of shell scripts to manage mail.
Using shell scripts for processing data.
Training for installation of Network

PAPER - IV

Business Data Processing
(45hrs) Introduction to data processing, records & file data collection, preparation, verification, editing and checking. Overview of business functions. Use of computer system for business applications. Spread sheets. Macros. Use of spread sheets in business. Business files. Introduction to data structures. Elements Fields and Records. Classification of files. Master files. Transaction files. Distributed processing. Various facilities for business computing. Introduction to databases.

Practicals
Analysis of a business system on paper.
Using spread sheets for payroll, balance sheets and other business applications.
Design of packages using Spreadsheet macros
Project of the spread sheet relevent to any local establishment.

PAPER - V

Structured Programming **(60hrs)**
Introduction. Need of structured programming. Various categories of programming languages (3GL, 4GL, etc.). Introduction to C. Program development in C using structured programming concepts. Details of modern header functions and library functions-implementation of available C packages inb specific programs.

Practicals
Development of an application using C.

PAPER-VI

Database Management Systems -I **(60hrs)**
Categorization of DBMS systems. Network, Hierarchical and relational databases. Application of DBMS systems. Relational data bases management systems. Why to use them and where. Data Description Language. Data Manipulation Language and Data Control Language. Introduction to

DBASE. DBASE commands. Development of an application under DBASE using forms, screens and .PRG files. Methods of documentation. Methods of analysing a program requirements. Data flow diagrams. Entity relationship charts. Flow charts. Security considerations in database management systems. Performance improvements in databases.

Practical
Design of a database for a business application.
Design of data entry forms and report layouts for this database.
Creation of programs to access and manipulate database.

PAPER- VII

Database Management Systems - II **(60hrs)**

Relational databases–advanced concepts. Introduction to ORACLE/INGRES or a similar RDBMS on a multiuser environment.
Structured query language. Form design on a advanced RDBMS. Report generator. Query by example and Report by form. Accessing RDBMS using programming languages. RQBE, SQL concepts in FOXPRO or other packages. System management. User management. Security considerations.

Practicals
Development of a business application in RDBMS.

PAPER - VIII

DTP **(60hrs)**

DTP packages. Microsoft windows. Various documentation cum DTP packages e.g. WordPerfect, Microsoft Word , TEX (V or La) etc. Introduction to pagemaker/ ventura or a similar package. Preparation of documents using DTP packages. Formatting. Printing. Various fonts and character sets. Various type of printers used in DTP. Introduction to commercial DTP systems available in market. Indian Language fonts. Installation of Indian Language fonts.

Practicals
Managing a Microsoft Window session.
Creating groups and program items under windows.
Tuning windows for a computer system
Preparation of a document and publishing it using a DTP system.
Creation of fonts.
Formatting using TEX

Mathematical Packages
Any mathematical software (mattcad, mathematica)
Any grapher software (HPG, Grapher etc.)

4. ELECTRONIC EQUIPMENT MAINTENANCE

PAPER -I
PRINCIPLES OF ELECTRONICS-I

(45 hrs)

Resistors
General Information: Symbol, colour Code, Types (such as carbon, metal film, thin-film, thick film, wire-wound). Variable resistors. Potentiometers (logarithmic linear multi-turm wire would rheostat.

Physical Properties: Temperature dependence (Thermister), Light Dependence (LDR), Voltage Dependence (VDR). Technical Specifications Wattage and working voltage. Methods of Measurement of Resistance- very low to very high values.

Inductors

General Information: Symbol, Types such as Air Core, Iron Core, Ferrite Core, Chocking Inductors (coil), Frequency response of an inductor. Method of Measurement of Inductance: using Universal Bridge, Design and Fabrication Rules.

Transformers

General Information: Principle, Types of Transformers such as Single Phasem Auto, Mains and Isolation Transformers. Frequency dependence of Transformers (Audio, IF and RF). Design of Mains Transformer and CVT.

Capacitors

General Information: Symbols, colour code, Types of Capacitors such as Air, Paper, Electrolytic, Mica, Tantalum, Polysterene. Fixed and Variable capacitors. Specifications of Capacitor: Power Factor, Working Voltage. Measurement of Capacitance: Universal Bridge. Application Areas.

Relays

General Information: Symbol, Types of Relays, such as Reed, Electromagnetic.
Specifications, Rating, Application Areas.

Microphones And Loudspeakers

General Information: Principle, Types. Specifications- Frequency Response, Input and Output Impedance, Power Rating, Size, Directionality (omni and uni-directional). Application Areas.

Transducers

Commonly used Transducers like LDR, Thermistors, Thermocouples, Photodiodes, Photo Transistors, IR Detectors, LVDT

Switches, Cables And Connectors

SPDT, DPDT, Band Switches, Touch Switches, Thump-wheel switches Micro-switches, specifications, Application Areas.

Batteries And Fuses

Dry Cells, Lead-Acid Accumulators, Nickel Cadmium Cells, standard Cells, Principle, Specifications
Fast and Slow Fuses, Pilot Lamps.

PCB

Types of PCB Layout Techniques, Fabrication Techniques

LCR And Waveshaping Circuits

Serial and Parallel Response, Idea of Black Box, Equivalent Circuits, Idea of Two Terminal and TwoPort Networks, Equivalent Circuits, Integration, Differentiation using RC Circuits, Clipping Clamping.

PAPER II

PRINCIPLES OF ELECTRONICS-II (45 hrs)

Number Systems

Introduction to Decimal, Binary, Octal, Hexadecimal Number system BCD Codes, Interconversions of Decimal, Binary and BCD Numbers, Parity. Excess-3, Grey and Johnson Codes- floating point representation of numbers.

Logic Gates

Positive and Negative Logic.
Different Logic Gates such as AND, OR, NOT, NAND, NOR, EXOR, Symbol and Truth Tables, Inverting and non-Inverting Buffers.

Binary Arithmetic And Boolean Algebra

Boolean Axioms, DeMorgan's Theorems: statement, Verification and Applications.
One's Complement, 2's complement representation, Half Adder, Full Adder, Subtractor.

Logic Families

TTL, ECL, & CMOS Parameters Like Power Dissipation, Speed, Supply Requirements, Logic level, Fan In, Fan Outn Noise immunity.

Combinational Circuits
Encoders, Decoders.
Sequential Circuits
Flip Flop (RS, JK, D, T, M/S JK) Shift registers, Counters. Semiconductor memories
Power Amplifiers
Transformer coupled. Equivalent circuit in Brief, Class A, Class B, Class AB and Class C. The constant Power Hyperbola, The AC Load Line Input and Output considerations, Determination of Non-Linear Distortion. Push-Pull Amplifiers: Phase Splitter circuit, complimentary push-pull, thermal runaway, heat sinks, Power rating of transistors, thermal resistance, power derating. Class B and Class C resonant load line amplifiers, gra[hical class C analysis, resonant load requirments.

PAPER-III

PRINCIPLES OF ELECTRONIC DEVICES-I (45 hrs)

IC 555
Specifications, Functional diagrams and operations and applications as timing device and wave form generation.
Introduction To Communication Systems
Basic principles and operation of communication system-basic ideas of modulation and demodulation.
Receiving Antennae
Antenna parameters like gain, beam width, radiation pattern, effective aperture, Ferrite and all types of antennas like wire telescopic, loop, dish, yagi, their construction and operating principles.
Superheterodyne Receivers
Principles, advantages, block diagram, RF input and antenna coupling arrangements, RF amplifiers, mixer, local oscillator, IF amp, deftector, audio amplifier, loud speaker, power requirements, tuning/aligning of receivers,waveforms and voltages at different check points, circuit reading of various radio sets, repair and trouble shooting, automobile radios.

Element of a Television System
Picture transmission, sound transmission, picture reception, sound reception, sound reception, synchronization.
Composite Video Signal
Scanning sequence details, sync details of the 625 line system, channel bandwidth, vestigial sideband transmission, reception of vestigial sideband signals, frequency modulation, FM channel bandwidth, channel bandwidth for colour transmission, allocation of frequency bands for television signal transmission, television standards.
Picture Tubes
Monochrome and Colour: Beam deflection, screen phosphor, face plate , picture tube characteristics, picture tube circuit controls.

PAPER IV

PRINCIPLES OF ELECTRONIC DEVICES-II (45 hrs)

Television Receivers
Types of television receivers, receiver sections, video detector, video section fundamentals, video amplifiers-design principles, video amplifier circuits, automatic gain control and noise cancelling circuits, sync separation circuits, sync processing and AFC circuits, deflection oscillators, vertical deflection circuits, horizontal deflection circuits, sound system, RF tuner, video IF amplifiers, receiver power supplies, television receiver antennae.
Television Applications
Television broadcasting, cable television, closed circuit television, theatre television, picture phone and facsimile, video tape recording (VTR), television via satellite, TV games, HDTV, flatpanel TV, teleconferencing.

Tape Recorders

Principles of magnetic recording, characteristics of magnetism, the hysterisis loop, recording head, recorded wavelength, response of head during replay, the effect of gap length, low frequency loss other losses, equalisation, the effect of non-linear characteristic of magnetisation, recording bias, A.C. bias, erasing the tape, block diagram of audio tape recorder, Oscillator, preamplifier, record (play back) head, erase head, tapes , mechanical transport system, stereo recording, double deck, single deck microphones (RF, cable), noise maintenance of mechanical parts,. head cleaners, head alignment, tone control graphic equalisers.

Telephones

Telephone receiver, line voltage and standards, dialing techniques-pulse dialing and tone dialing, trouble shooting of telephone receivers, principle of electronic exchanges, modem, STD, ISD, EPBAX, Intercom-stress on equipment and EPBAX, value added services like FAX, e-mail.

Measuring Instruments

Multimeters analog/digital, oscilloscopes, signal generators, noise and sound level meters, frequency counters, error soruces and precautions during measurement.

General Note:

Familiarisation with catalogues, standard specification, knowledge about companies referring to service manual.

Books

1. Fundamentals of acoustics-Kinsler and Frey.
2. Systems trouble Shooting Handbook-Luces M. Faulkenberry. (John Wiley & Sons, 1986).

PAPER - V

MICROPROCESSOR BASED ELECTRONICS-I

(60 hrs)

Microcomputer Fundamentals

Introduction, simplified microcomputer architecture, simplified memory organisation, instruction set, simplified CPU organisation, microcomputer operation.

The 8085 Microprocessor

Data sheet descriptions, pin diagram and function, microprocessor architecture, using the data /address register, using the stack pointer.

Interfacing The Microprocessor

Introduction, interfacing with ROM, interfacing with RAM, input/output interfacing basics interfacing with practical I/O ports, synchrnoising I/O data transfer using interrupts, address decoding

Programming The 8085 Microprocessor

Machine and assembly languages, simplified instruction set, instruction set, arithmetic operations, instruction set-logical operations, instruction set-data transfer operations, instruction set-branch operations, instruction set-subroutine call and return operations, instruction set-miscellaneous operations, writing a program, addressing modea, program branching, program looping, using subroutines. stack, I/O, and machine control instructions.

PAPER-VI

MICROPROCESSOR BASED ELECTRONICS-II

(60 hrs)

Programming Techniques For 8085 Microprocessor

Introduction, straight line programmes, looping programmes, mathematical programmes.

Applications To Illustrate Use Of Microprocessor In:

1. Traffic control
2. Temperature control

3. Digital clock
4. Stepper motor control
5. Washing machine control

Personal Computer Organization And Word Processor

PAPER-VII

TROUBLE SHOOTING AND MAINTENANCE OF AUDIO/VIDEO EQUIPMENTS-I

(60 hrs)

Television

Trouble shooting procedure, trouble shooting monochrome receivers, serviciang of various functional blocks, trouble shooting colour receivers, servicing circuit modules, safety precautions in Television servicing

.Television Camera Tubes

Basic principles and maintenance, direct recording

Block Diagram of VCR

Requirement of VCR, rotating video drums, helical scan, guard band, frequency response, servo systems, tape tension regulator, reel servo, system control. Different formats, quadrouplex format, type B segmented format, type C format, the U matic format, the .5 inch VHS format, β-max system.

Signal Processing and Chrome Processing

Colour under technique, recovery of down converted chrome signals, luminance processing-frequency modulation, deviation and bandwidth, automatic gain correction, limited, pre-emphasis, replay of luminance signal, Y/C delay, drop out compensator, block diagram of main requirements, zero guard band system , turners and modulators, the modulator.

Servo Mechanisms And System Control

Recording , Play back, tracking, Capstan servo system control, loading and threading and play mode, record mode, auto stops. counter, audio video mutingy.

Care of Mechanical System

Cleaning of heads and tape path, lubrication, replacement of parts, replacement of audio or CTC head, replacement of video drums, dihedral error, table height, tape tension, reel drive tongue, stop breaks.

PAPER-VIII

TROUBLE SHOOTING AND MAINTENANCE OF AUDIO/VIDEO EQUIPMENTS-II

(60 hrs)

Electronic System Alignments

Instruments, fault finding - the power supply, free running speed, the servo system, tracking, video system, play back section alignment, amplifier balance and gain, luminance signal adjustments, D.O.C., FM modulator, limited balance, carrier leak, noise canceller, colour processing, up conversion, automatic colour correction, automatic phase connection, recording , liminance, sync, tip or clamping frquency, deviation set, white clip, chrominance, summary.

Remote Control And Special Circuits

Remote control, electromechanical control systems, electronic control systems, electronic touch tuning, frequency synthesizer, T.V. tuner, automatic fine tuning (AFT), booster amplifiers , automatic brightness control, instant - on circuitary, picture tube boosters.

Alignment And Servicing Equipments

Anti static and low leakage multimeter, soldering iron, vacuum tube voltmeter (VTVM), cathode ray oscilloscope (CRO), signal generator, video pattern generator, colour bar generator, vector scope, high voltage probe, cable connectors, shielding and grounding .

New Technologies

Industrial aspects of consumer electronics, jigs and fixtures, quality control/management, production techniques, business cycle, new technologies, compact disc, laser disc.

Books:

1. TV Servicing hand book-- Gordan J. King Mewhnes Butterworths
2. TV fault finding complied by the staff of the Radio constructors---Data Publications
3. How to trouble-shoot a TV receiver D.B. Taraporevale and Co. Pvt. Ltd.--J.R. Johnson
4. Effective TV production----- Gerald Millerson.
5 Modern Electronic Equipment - R.S.Khandpur (TMH)

5.COMPUTER SYSTEM MANAGEMENT

PAPER I

INTRODUCTION TO COMPUTER SCIENCE

(45 hrs)

Introduction to digital computers-functional units-secondary storage representation of data, Machine language, Assembly language, Assembles, High level languages, compilers and interpretersm Problem definition, Algorithm development, Flow charting, Pseudo coding, editing-editor, Testing-compile, link, load, Run-debugging, documentation, structured Programming, Object oriented programmes.Programming in Pascal-Syntex rules-simple types-expressions-conditional statements, iterative statements, user defined data types, programming examples,Structured data types-Arrays, records, sets, files, input, output, text files, pointers and Dynamic variables-functions and procedures-Recursion, programming examples-Nu and Pc tools.

Books

1. Introduction to Pascal and structured design-DALE & ORSHALICK
2. Programming with Pascal, SHAUM'S OUTLINE SERIES, Gottfied, TMH

References:-

1. Pascal user manual and report-K Jenson & N Wirth, Narson Publishing house, ND.
2. Programming and problem solving with Pascal-B. Michel Schneider, Steven W Weingert & Davil M Priman. WEL.

PAPER-II

DATA STRUCTURES - I

(45 hrs)

Introduction to programming methodolofies-structural approach, stepwise refinement techniques, rogramming styles, documentation-analysis of algorithms, frequency count, study of basic data structures-Veetors, arrays, records, stacks, queues and dqueues.Development Programmes using D structures

Books

1. Introduction to data structures with application-Trembly and Sorenson, TMH
2,. Data Structures and Programme design-Robert and Kruse, EEE
3. Programming in ANSI C - Ram Kumen and Rakesh Agarwal, TMH

References

1. Theory and problems of data structures-Seymour Lapschnut, Shaum's Series.
2. Algorithms & Data Structures-Programmes- M.Wirth, Printice Hall, Englewood Cliffs.
3. Structural approach to programming-J.M. Hugges and J.IU. Michtm, Printice Hall.

PAPER-III

COMPUTERS HARDWARE FUNDAMENTALS-I

(45 hrs)

Overview of-Boolean operations, Basic Demorgans and Boolean fun ctions, canonical and standard forms, simplification of Boolean functions, conversion of Truth tables to Boolean expressions, minimizations of Truth table using K-mapMinimization of switching function-tabulation method-Processor organization-designof arithmetic unit, logic unit, Arithmetic logic unit and shiffer-status register-Processor unit-Design of Accumulator.Control organization-Design of hardwared control-Control of processor unit-PLA control-micro programme control-Micro instructions-Nano memory and Nano instructions-unicroprogram-sequencer-micro programmed CPU organization.

PAPER-IV

DATA STRUCTURES -II

(45 hrs)

Logical characteristics of strings, Physical representations for strtings-linked list-trees, Binary tree, traversals graphs-application.Storage management-Free storage lists, references counters, garbage collection, storage compaction, boundary tag method Internal and external storing techniques-selection, bubble insertion, merge sorting, Partition exchange sorting , heap sort, searching-lenier and binary-hashing.External and Internal sorting-sorting with disks, sorting with tapes.

PAPER-V

'C' LANGUAGE PROGRAMMING

(60 hrs)

'C' Preliminaries
Data types, expression evaluation, procedure rules, type conversion, sequential structuure, selective structure,repetitive structure, functions, arrays, pointers, structures and unions, operations on bits, file processing pre processordentifiers and key words, constants, variables and arrays, declarations, expressions.
'C' Operators,
Arithmetic operators, unary operators, relational and logical opeators, assignment operators, conditional operators and library functions.
Input/output statements.
Single character input/output, formated input/output, input/output of string constants and variables.
Contnrol Statements
WHILE statement, DO-WHILE statement, OR-statement, IF-ELSE statement, switch statements, Break statements, continue statements, comma operator and GO-TO statements.
functions
Defining a function, accessing a function, Passing augments to a function, specifying augment data types,

PAPER- VI

COMPUTER HARDWARE FUNDAMENTALS-II

(60 hrs)

Digital interfacing-Programable parallel posts and handshake input/output, implementation with 8255-programmable parallel post device, internal architecture, mode zero, one and two operations.

Introduction to microcomputers-types, overview of structurue and operation-micro processoros evolution and type, internal architecture of intel 8085, programming, addressing modes, 8085 Assembly language programming development steps, machine code constructions.
Internal architecture of 8086 microprocessor, addressing mode, instruction set and assembly language programming.
Memory organization-Basic concepts, semiconductor RAM memories, memory stem consideration, semi conductor ROM memories, multiple module memories and inter leaving, cache memory, virtual memory, segmentation, Paging, Associate memory.
Practical implementation of LAN Internet.

Books

1. Digital logic and computer design-M.Morris Mano PHI edition
2. Computer organization V Carl Hamachehhr, 2 Venko, G. Varnasic-Mc Graw Hill
3. Micxroprocessors & Programmed Logic-Kenneth L. Shot

References

1. Computer architecture and organization-H.P. Hayes Mc Graw Hill
2. Computer architecture and parallel processing-K.Hawage & Briggs Mc Graw Hill
3.Digital system design and microprocessors-John P, Hays, Mc Graw Hill
4. Introduction to microprocessors-Adithya P Mathur 3rd edition and above.
5. Computers organization programming-C.W. Gear, Mc Graw Hill Int. Student edition
6. Introduction to computer system using PDP-II and Pascal Glenn H. Mal. Even, Mc Graw Hill.

PAPER - VII

SOFTWARE ENGINEERING

(60 hrs)

Software engineering Principles
Software engineering as an engineering principle, information system characteristics, software develolpment process models, life cycle concepts, software phases and deliverables, software developments strategies.
Technichal developments
Structured systems analysis and design requirements collection and specification, data flow and logical data modelling, cost benefit analysis, feasibility study, network, control and user interface designs, physical data designs, dynamic modelling for real time systems.
Software Project Management
Principles of software project management, organizational and team structures, project planning, project inititation and project termination, technichal, quality and management plannes, project controls, cost estimation methods, function points and COCOMO, Tools.
Software quality managment
Quality control, quality assurance, quality standards, software metrics, verification and validation, testing, quality plans, tools.
Configuration management Soft ware development methods and CASE
Formal, semi formal and informal methods, data, functions and event based modelling, some of the popular methodologies such as Yourdon's SAD, SSADM etc., CASE tools, CASE srandards.
Implementation
In GL environment, in 4 GL environment, in client -server environment, coding styles

Book

Software Engineering-A practitioners approach(3rd edition) by Rojer. S Pressman, Mc Graw Hill International 1992.

PAPER-VIII

OPERATING SYSTEMS

(60 hrs)

Fundamentals of operating systems
Monitors, buffering, spooling, multi programming, time sharing, protection, operating system components, operating system services, operating system machines, operating system design and implementation

Processes
Process states, process managements, process scheduling, context switching, concurrent processes, producer, consumer problems, interprocess communication, critical sections, sema phores, monitors, language constructs for concurrency.CPU scheduling, performance criteria, scheduling algorithms

Deadlocks
Characterisation, prevention, detection, recovery.

Memory management
Basics memory partitioning, swaping, paging, segmentation, virtual memory (basics, demand paging, page replacement, algorithms, thrashing, performance) Input/output hardware and software interrupt handlers, device drivers, device cvontrollers, direct memory access.

File systems
File concepts, access methods, directory systems, file protection methods,

Units operating systems
Basic design principles concepts of Kernel and Shell, fundamentals of file systems and process model

Books
1. Operative system concepts by J.Peterson and A. Silberschatz, Addison Wesley 1985.
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