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॥ अंतरी पेटवू ज्ञानज्योत ॥

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North Maharashtra University,
Jalgaon

Syllabus for S.Y.B.Sc.

PHYSICS

W.E. From June, 2003

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NORTH MAHARASHTRA UNIVERSITY, JALGAON.

CORRECTIONS.

S.Y.B.Sc. Physics.

There is a note on page number 2 as :

“ Every college should have minimum 10 Computers with Internet facility & Computer Fundamental-II should be taught on Computer with Interactive Basis ”.

This note is to be modified & read as under :

- (i) Department of Physics should have minimum 5 Computers with Internet facility to conduct S.Y.B.Sc. Physics practicals.
- (ii) Computer Fundamental-II is expected to teach using Computer on interactive basis.

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**Syllabus Structure for S.Y.B.Sc. Physics.
(W.E.From June, 2003)**

<u>Physics Paper-I</u> :	Unit I	-	Quantum Theory.
	Unit II	-	Computer Fundamental-II.
	Unit III	-	Waves and Oscillations.
	Unit IV	-	Solar Energy.

<u>Physics Paper-II</u> :	Unit I	-	Basic Electronics.
	Unit II	-	Digital Electronics.
	Unit III	-	Optics-II.
	Unit IV	-	LASER.

OR

<u>Physics Paper-II</u> :	Unit I	-	Instrumentation-I.
	Unit II	-	Instrumentation-II.
	Unit III	-	Optics-II.
	Unit IV	-	LASER.

Physics Paper-III : **Practical**

Section I	-	Group-I (A) Modern Physics. (B) Solar Energy.
		Group-II (A) Waves & Oscillations. (B) Computer Fundamental-II.
Section II	-	Group-III (A) Optics. (B) LASER.
		Group-IV(A) Basic Electronics. (B) Digital Electronics.

OR

Group-IV Instrumentation I and II.

Physics Paper-I

Unit I: Quantum Theory

1. **Charged Particles** : Motion of charged particle in electric , magnetic, electric and magnetic fields, Lorentz equation, Millikan's method for determination of charge on electron, Thomson's method to determine the e/m of an electron. (5P, 6M)
2. **Theory of hydrogen atom** : (Revision of Bohr's Theory of hydrogen atom) Extension of Bohr's theory, experimental verification of discrete atomic energy levels, Frank-Hertz's experiment, correspondence principle, Bohr- Sommerfield model and relativistic effects. (5P, 6M)
3. **Matter waves** : Origin of quantum mechanics (With illustration of photoelectric effect), dual nature of matter, de Broglie hypothesis, wave packet, particle velocity, phase velocity, group velocity and relation between them, electron diffraction, Davisson and Germer experiment, uncertainty principle, Thought experiment(Gamma ray microscope), different forms of uncertainty principle, applications of uncertainty principle (Non existence of electron in nucleus, determination of ground state of electron and size of hydrogen atom). (10P, 8M)
4. **Wave mechanics** : Wave function and its physical significance, formulation of Schrodinger's time dependent and independent equations (1-D), applications of Schrodinger's equation to particle in 1-D rigid box. (6P,5M)

Unit II : Computer Fundamental - II

1. Word processing with word for windows :

Word processing : Definition, uses, advantages, getting acquainted with Word 2000.

Creating a new document : create, save, moving around the document, close.

Editing of text : Retrieving saved document, inserting, deleting, selecting, copying, moving the text, using spell and grammar check, undoing, redoing, search and replace feature.

Formatting the text : Font, size, alignment, tab setting, line spacing, bulleting and numbering, bordering, shading, setting page margins, headers and footers, page size and orientation.

Table : create, modify, table arithmetic, formatting, using Draw tables and eraser tools.

Graphics : Inserting clipart graphics, inserting object, drawing with draw tool bar, creating watermarks, formatting of watermark.

Mail merge : performing the mail merge.

Printing : page set up dialog box, print options. (10P, 10M)

2. Excel 2000 :

Introduction, getting acquainted with Excel screen elements, tools of tool bar, understanding data and data types, editing the data.

Editing of worksheets : Retrieving saved worksheets, selecting data, inserting and deleting cells, columns, rows, moving and copying cells, spell checking, entering comments, data validation, formatting of worksheets.

Managing of worksheets : Inserting a new worksheet, moving and copying worksheets, opening multiple windows.

Formulas and Functions : working with formulas, working with functions.

Creating charts : creating a simple chart with chart wizard, working with elements of charts, creating various types of charts.

Database management in Excel : Database structure in Excel, sorting the database, creating reports, filtering database.

Printing worksheets : Print set up, print options. (10P,10M)

3. Introduction to Internet:

History, use, DNS and IP address, www, web browsers, search engine, E-mail. (6P, 5M)

Note: - Every College should have minimum 10 computers with Internet facility & Computer fundamental-II should be taught on computer with interactive basis.

Unit III : Waves and Oscillations

1. **Damped harmonic motion :** Differential equation of damped harmonic oscillations and its solution (discussion of different three cases), Logarithmic decrement, energy of damped harmonic oscillator, quality factor (8P,7M)
2. **Forced oscillations:** Idea of forced oscillations, resonance, Barton's pendulum, differential equation of forced oscillations and its solution, amplitude of forced oscillations, amplitude resonance, power in forced oscillations, quality factor, band width. (10P,9M)
3. **Wave motion :** The plane wave equation and its solution, transverse wave along a stretched string, characteristic impedance of a string to a transverse waves, longitudinal waves in a compressible medium, acoustic impedance of an elastic medium to sound waves. (8P,9M)

Unit IV : Solar Energy

1. **Energy Sources :** conventional and non conventional energy sources, energy crisis, energy alternatives, solar energy as an option, solar radiation (beam, diffuse and global radiation), spectral distribution of solar radiation, pyranometer. (6P,5M)
2. **Photothermal conversion :** Flat plate collector, liquid flat plate collector, thermal applications : solar air heater, solar water heater, solar cooker, distillation and drying. (6P,6M)
3. **Concentrating collectors :** General characteristics, definitions of aperture, concentration ratio and acceptance angle, Types of concentrating collectors : flat plate collectors with plane reflectors, cylindrical and parabolic collectors. (description only). (4P,5M)

4. **Photovoltaic conversion** : Principle of photovoltaic conversion , p-n junction, solar cell, materials used for solar cell, types, construction and working of solar cell (PN, PIN, MIS), spectral response of solar cell, I-V characteristics of solar cell under dark and illuminated conditions, open circuit voltage, short circuit current, fill factor and efficiency of solar cell. (10P, 9M)

Reference Books :

1. Concept of Modern Physics – Aurthcr Beiser (3rd edition)
2. Atomic Physics – J. B. Rajam.
3. Using Microsoft Office 2000 by technical team-Vipro Computers, Nashik.
4. Microsoft Office 2000 complete – BPB Publications New Delhi.
5. The Physics of Waves and Oscillations – N. K. Bajaj.
6. Waves and Oscillations – B.S. Agrawal.
7. Waves and Oscillations – N. Subrahmanyam & Brijlal.
8. Solar Energy - S. P. Sukhatme.
9. Solar Energy Utilisation - G. D. Rai.
10. Principles of photothermal applications – Duffie & Backmann.
11. Experiments in solar energy - H.P. Garge, Narosa Publishing House, Delhi.
12. Solar energy Fundamentals - H.P.Garge , Tata MacGraw Hills, Pub.

----- Physics paper -II

Unit I : Basic Electronics

1. **P-N Junction** : P-N junction diode, formation of depletion layer and barrier potential, I-V characteristics of junction diode, reverse saturation current, reverse breakdown (Zener, Avalanche), Zener diode, equivalent circuit of Zener diode, I-V Characteristics of Zener diode, Zener diode specifications, ($P_{Z,max}$, I_z , r_z , v_z), construction and working of LED. (6P,6M)
2. **Rectifiers and Filters** : (Revision of half wave, full wave and bridge rectifiers) ripple factor for half and full wave rectifier, filters : inductor filter, capacitance filter and π filter. Concept of voltage regulation, Zener diode as a voltage regulator, current limiting resistor, optimum load. (6P,7M)
3. **Bipolar Junction Transistor** : NPN and PNP transistors, operation of transistor, transistor configurations (CB, CE, CC), current gain α , β and their interrelationship, Input and output characteristics of a transistor in common emitter configuration.
Transistor biasing : Need of biasing, types of biasing (only listing), Fixed bias method in detail, d. c. load line. (6P,6M)
4. **Transistor Circuits**: Small signal single stage R-C coupled common emitter amplifier, frequency response characteristics and band width.
Sinusoidal Oscillators : Types of feedback, the Barkhausen criterion, Oscillatory circuit (tank circuit), Hartley oscillator. (8P,6M)

Unit II : Digital Electronics

1. Number System :

Decimal number system, Binary numbers system, binary to decimal conversion, decimal to binary conversion, fractional decimal to binary conversion, binary arithmetic, signed binary numbers, 2's complement arithmetic, hexadecimal numbers, hexadecimal to decimal conversion, decimal to hexadecimal conversion, BCD numbers. (9P, 8M)

2. Digital circuits: Types of logic, logic gates using DTL (OR, AND, NOT, NOR, NAND, X-OR) with logic expressions, De Morgan's theorems, NAND realization of logic gates. (9P, 9M)

3. Multivibrators: Astable, monostable, and bistable multivibrator (Transistorised), R-S, J-K and D type flip flops using NAND gates. (8P, 8M)

Unit III: Optics - II

1. Diffraction :

i) Concept of phenomenon of diffraction, Types of diffraction.

ii) Fresnel diffraction : Fresnel half-period zone (Rectilinear propagation of light)

iii) Fraunhofer diffraction : Fraunhofer diffraction at a single, double slit and its intensity distribution pattern.

iv) Diffraction Grating : Theory of plane transmission grating, Resolving power, Rayleigh's criterion of resolution. (14P, 13M)

2. Polarisation :

Concept of Polarisation, Polarisation by reflection, Brewster's law, Geometrical properties of uniaxial crystals. Double refraction in uniaxial crystal, Polarisation by double refraction, Double refracting crystals, (Negative and positive), Huygen's Explanation for normal incidence, Retardation plate (Quarter and half wave plate), Polaroid, optical activity, specific rotation. (12P, 12M)

Unit IV : LASER

1. Introduction to Laser : Basic steps required to form laser : absorption, Spontaneous emission, stimulated emission, optical pumping, population inversion, metastable state. Characteristics of Laser : directionality, intensity, monochromaticity and coherence. (10P, 9M)

2. Types of Laser: (Principle of operation, construction, energy level diagram, advantages and disadvantages) Ruby Laser, Gas Laser, and Semiconductor laser. Applications of Laser (listing). (16P, 16M)

Reference Books :

1. Electronic Principle - Malvino.
2. Electronic fundamentals and applications - J.D. Ryder.
3. Principles of electronics - V.K.Mehta.
4. Digital principles & applications - Malvino & Leach.
5. Digital electronics R.P. Jain.
6. Fundamentals of Optics (4th edition) - Jenkins and White.
7. The book of Optics - Subrahmanyam and Brijlal
8. Principles of Optics - B. K. Mathur
9. Optics - Ajay Ghatak.
10. Optics and atomic physics - D.P. Khandelwal.
11. Laser and non linear optics - B.B.Laud.
12. Industrial electronics - Itkakar et. al.
13. Laser - Bela A. Lengyel.

Physics Paper- II

Unit I : Instrumentation - I

1. Basic principles of measurements :

Different units, standards of measurements, calibration, Accuracy, Precision, sensitivity, Linearity, Stability, Concept of errors and their types, Concept of sensors (8P, 8M)

Measurement of temperature:

Measurement of temperature using :

I. Non electrical methods:

- i) constant volume thermometer
- ii) Vapour pressure thermometer

II. Electrical Methods:

- i) Metallic resistance thermometer (Platinum resistance thermometer)
- ii) Semiconductor resistance sensors (Thermistors)
- iii) Thermoelectric sensors (Thermocouple)

III. Radiation Methods:

- i) Optical pyrometer
- ii) Total radiation pyrometer (12P,12M)

Measurement of Pressure:

- i) Measurement of high pressure
- ii) Measurement of low pressure by using, (a) McLeod Gauge, (b) Pirani Gauge
- iii) Calibration and Testing (Dead weight tester) (6P, 5M)

Unit II : Instrumentation II

1. Measurement of Flow :

Classification of flow meters. Expression for rate of flow using Bernoulli's Theorem,

Measurement of flow using :

- i) Head type flow meters - Ventury tube, Pitot tube
- ii) Rotameters
- iii) Mass flow meters. (10P, 9M)

2. Measurement of magnetic field :

Different methods of production of magnetic field,

Measurement of magnetic field by using :

- i) Search coil
- ii) Hall gauge meter (8P,8M)

3. Acoustic Measurements :

Characteristics of sound, sound pressure and power levels, variation of intensity of sound with distance, typical sound measuring system (sound level meters).

Microphones :

- i) Condensor & capacitor type
- ii) Electrodynamic type
- iii) Carbon granules type (8P,8M)

(Please note : P for Periods, M for Marks)

References :

1. Instrumentation : Measurement and Analysis : Nakra and Chaudhari
2. Instrumentation : Devices and System : Rangan, Mani, Sharma.
3. Electricity and Magnetism : Khare, Shrivastav.
4. Electricity and Magnetism : D. C. Tayal.
5. Electronic Instrumentation and Measurement Techniques : Herrick Cooper.

Paper III : Practical

Note : At least four experiments from each group.

SECTION –I

Group I

A) Modern Physics (any two)

1. Characteristics of photocell (characteristics and stopping potential).
2. Determination of electronic charge using p-n junction diode.
3. To estimate energy gap of semiconductor .
4. Determination of Planks constant using photocell

B) Solar energy (any two)

1. I-V Characteristics of solar cell (fill factor and efficiency).
2. To compare the luminous intensities of two light sources using photo voltaic cell.
3. Study of liquid flat plate collector (efficiency of solar collector).
4. Study of solar distillation plant (comparison of pH values).
5. To find F_1 and F_2 values for box type Solar cooker.
6. To find efficiency and heat balance of Solar concentrator.

Group II

A) Waves and Oscillations (any two)

1. To determine equivalent length of kater's pendulum using phenomenon of amplitude resonance.
2. Log – decrement
3. Bottle as a resonator.
4. Kund's tube (determination of velocity of sound)

B) Computer fundamentals II (any two)

1. To create an application letter using 'word'.
2. Drawing with draw tool bars using 'word'.
3. Ceate various types of charts using 'excel'.
4. To create marks statement using 'excel'.
5. Introduction to internet surfing and e-mail.

SECTION –II

Group III

A) Optics (any two)

1. Double refracting prism.
2. Diffraction grating.
3. Fresnel's biprism.
4. Newton's rings and refractive index.
5. Polarimeter.
6. Verification of Brewster's law.

B) Laser (any two)

1. Determination of power distribution within the laser beam.
2. To Measure the beam divergence of Laser.
3. Measurement of beam size of Laser.
4. To determine the wave length of laser.

Group IV

A) Basic Electronics (any two)

1. Study of Zener regulated power supply.
2. Bridge rectifier with capacitor filter and measurement of ripple factor.
3. Transistor characteristics (CE).
4. Single stage transistor amplifier.
5. Hartely oscillator.

B) Digital Electronics (any two)

1. Study of astable multivibrator using transistors.
2. Study of 'AND' and 'OR' gate using diodes.
3. Study of AND, OR, and NOT gate using IC's.
4. To verify the Demorgan's theorem using IC 7400 and IC 7404.

OR

Group IV : Instrumentation I and II (any four).

1. Platinum resistance thermometer.
2. Thermister.
3. Use of CRO (calibration of voltmeter).
4. Measurement of magnetic field by hall probe method.
5. Bernoulli's theorem.
6. Directional characteristics of microphone.
7. Velocity of sound by phase shift method.
8. Lissajous figures using C.R.O.
