TRIPURA UNIVERSITY

(A Central University)
Suryamaninagar-799022

Syllabus

OF

Physics
(General & Major)

Semester – V

2014

Fifth Semester

HONS syllabus

Subject: Physics

Total Marks 100 + 100 = 200

Paper Name : Theory paper: H5 = 100 marks

Practical paper: H6 = 100 marks

Fifth Semester: Paper = H5
Theory = 100
(80 + 20 internal)
Four units : each unit has (20 + 5 marks internal)

UNIT-I
Mathematical Methods in Physics – II: [20 (Exam) + 5(internal)]

Partial differential equation: Laplace equation and wave equation and their solutions in Cartesian, spherical polar and cylindrical polar coordinates by the method of separation of variables.

Series solutions of Legendre, Hermite, and Laguerre's differential equations, orthogonality of the solutions and recurrence relations.

Complex Variable: Complex variable and function of a complex variable, continuity, differentiability, singular points, removable singularities, essential singularities, isolated singularities, poles, singularity at infinity, Branch points, Branch cuts, Riemanns' sheet and Riemann Surface, single and multi-valued function, idea about complex plane, analytic function and necessary and sufficient condition for a function to be analytic;- Cauchy Riemann Equations, harmonic functions, Cauchy Riemann Equations in polar co-ordinates.

Laplace transform, properties of Laplace transform, important formulae related to Laplace transform, Laplace transform of the derivative of $f(t)$, Laplace transform of the integral of $f(t)$, Laplace transform of t. $f(t)$, Laplace transform of $\frac{f(t)}{t}$, evaluation of integrals using Laplace transform,

UNIT-II
Atomic and Molecular Physics, Laser and Fiber Optics: [20 (Exam) + 5(internal)]

Spectrum of hydrogen atom with reduced mass correction, vector atom model, qualitative idea of Bohr-Sommerfeald model, space quantization, Stern-Gerlach experiment and intrinsic spin of electron, magnetic moment of electron, Bohr magneton.

Spectroscopic notations, L-S and J-J coupling, lande g-factor, spectra of alkali atoms, doublet structure of spectral lines, normal and anomalous Zeeman effect.

Basic ideas about molecular spectra, rotational and vibrational spectra of diatonic molecules (see appendix).

Compton effect and calculation of Compton shift.

Laser: Population inversion: Einstein's A & B; coeffients; feedback of energy in a resonator, 3-level and 4-level systems; Ruby, Helium-Neon and semiconductor lasers. Laser applications, holography (Basic principle).

Optical Fibre: Core and cladding, total internal reflection; optical fibre as waveguide; step index and graded index fiber, communication through optical fibres, energy loss, band width and channel capacity- a typical system, attenuation and dispersion, splicing and couplers, fibre sensor.

UNIT-III
Electronics (Analog): [20 (Exam) + 5(internal)]

Applications of PN junction diode: bridge rectifier, clipper and clamper.

Transistors, working of PNP and NPN transistor, current components in a junction transistor, CB, CE and CC configurations and their comparisons.

Transistor characteristics in CB, CE, and CC configurations, definition of α, β and their interrelations. Working of a CE transistor amplifier, hybrid parameters, analysis of small signal single stage low frequency CE transistor amplifier with hybrid parameters, calculation of current gain, input impedance, voltage gain and output conductance.

Transistor biasing, fixed bias and its disadvantage, self bias or emitter bias and its advantage with respect to stability, voltage divider method.

Field effect transistor (FET) and its difference from bipolar transistor, n and p-channel FET, FET operation, FET characteristics: static and dynamic characteristics, FET parameters and their relation, use of FET as a voltage amplifier and calculation of voltage gain.

Operational amplifier (ideal), concept of virtual ground, uses of OP-AMP as an inverter, phase shifter, adder, differentiator, integrator, solution of simultaneous equation, real OPAMP – input offset voltage, input offset current, common mode rejection ratio and slew rate square wave and triangular wave generator.

Feedback amplifiers; positive and negative feedback, voltage gain with feedback, Barkhausen criterion for oscillator, Hartley, Colpitt and Wien Bridge oscillators with transistors and FET, qualitative description and advantages of crystal oscillator.

Principle of radio transmission and reception using block diagram.

Ionosphere: different layers, their role in radio wave propagation.

UNIT-IV
Statistical Mechanics: [20 (Exam) + 5(internal)]

Systems and ensembles, microstates and macro-states, calculations of microstates and macro-states in different cases, postulate of equal apriori probability, concept of chemical potential, micro-canonical, canonical and grand canonical ensembles, few examples of different ensembles from the physical world, phase space and its features, dimension of elementary phase cell, thermodynamic probability and its calculation in various cases, partition function and its significance, calculations of partition functions in different cases, Planck-Boltzmann definition of entropy, entropy and probability, third law of thermodynamics and its consequences, most probable distribution, derivation of distribution function for Maxwell-Boltzmann for a system of non-interacting particles, equipartition of energy and Richardson-Dushman equation from classical statistical mechanics.

Spin angular momentum of identical and indistinguishable particles and their symmetry requirements, calculations of macrostates, microstates and wave functions in case of assemblies of identical and indistinguishable particles, Bose-Einstein and Fermi-Dirac statistics for a system of non-interacting particle,

Fifth Semester: Practical Paper = H6
(Total marks: 100)

Marks division:

40 marks = Two hour written examination of 40 short / MCQ practical based questions to be supplied by the Head Examiner

10 marks = Laboratory note book

50 marks = performance of the experiment.

Advance Practical

Experiment No.	Name of Experiment
1	Determination of wavelength by Fresnel's biprism.
2	Determination of wavelength of spectral line by plane transmission grating.
3	Determination of J by callender and Barnes method
4	Drawing of B-H loop and determination of hysteresis loss.
5	Measurement of self-inductance by Anderson's bridge.
6	Determination of the Q-factor for LCR resonant circuit for different frequencies.
7	Determination of susceptibility of a magnetic material.

N.B. Out of seven practical experiments, a minimum of six experiments have to be set up in the laboratory by the concerned department and must be completed by the students. **Otherwise no practical marks will be given.**

Fifth Semester

General Syllabus

Subject: Physics

Total Marks 50 + 50 = 100

Paper Name : Theory paper: 501(T) = 50 marks

Practical paper: 502(P) = 50 marks

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Fifth Semester Syllabus

Paper PH-501 (T)

Full marks: 50 (Internal Assessment: 10, Semester Exam: 40)

Total Lecture 40, (Each lecture period = 1 hour)

Unit-I: Electromagnetic Theory and Laser & Computer Science, Programming and Digital Electronics
Total Lecture Period: 20
(Total: 25 marks, Internal Assessment: 05, Semester Exam: 20)

Electromagnetic Theory and Laser, Maxwell's electromagnetic equations, propagation of plane electromagnetic waves in free space, transverse character of an electromagnetic wave, , energy density in transverse field, Poynting Theorem.

Qualitative idea of co-axial cable, optical fibre: Structure, Step index fibre, graded index fibre, Single and Multimode Propagation, different losses in fibre, advantage of optical fibre over the co-axial cable media.

Temporal and spatial coherence, Einstein's A and B co-efficient, LASER as monochromatic source of light, spontaneous and stimulated emission, population inversion, optical pumping, Ruby LASER.

Computer Progamming and Digital Electronics

Essential parts of an electronic computer, CPU, INPUT, OUTPUT, Devices, RAM, ROM, CD-ROM, Familiarity with different operating systems with common use, Machine language, Assembly language (idea only), Characteristics and field applications of high level languages such as BASIC, FORTRAN, C and C++, Algorithm and flow chart for solving simple problems, Simple MS-DOS Commands, Development of simple programs in BASIC language using commands listed - AUTO, CLOSE, CLS, DATA-READ, DAE, DEFFN, DELETE, DIM, END, FILES, FOR-NEXT, GOSUB-RETURN, GOTO,IF-THEN, IF-THEN-ELSE, INPUT, KILL, LET, LINE, LIST, LPRINT, NEW, PRINT, REM, RUN, SAVE, SCREEN, STOP, SYSTEM.

Binary system, binary numbers, binary to decimal and decimal to binary conversion, AND, NOT, NAND, NOR, XOR, XNOR gates, circuits with discrete components. De Morgan's theorem and applications, Half adder and full adder, RS flip flop and D-flip flop.

Unit II: **Quantum Mechanics I and Quantum Mechanics II**
Total Lecture Period: 20
(Total: 25 marks, Internal Assessment: 05, Semester Exam: 20)

Quantum Mechanics I

Black body radiation and discussion of the failure of classical theory with special mentioning of Wein's law and Rayleigh-Jean's formula, Plank's hypothesis and Plank's energy distribution law in black body radiation. Dual character of radiation, de Broglie hypothesis of matter wave, de Broglie wavelength.

Heisenberg uncertainty principle and time-energy uncertainty principle, experimental illustrations diffraction by a single slit, complementary principle.

Quantum Mechanics-II

Schrodinger's equation and its derivation, operator, eigen function and eigen values, representation of position, momentum and energy by quantum mechanical operator, Born's interpretation of wave function, required properties of wave function.

Solution of time independent Schrodinger Equation for a free particle in one dimensional box with infinite potential walls at x=0 and at x=l, normalization of wave function and '$|\Psi|^2$-x'graph, energy level diagram, zero point energy.

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Fifth Semester Syllabus

Paper PH-502 (P)

Full marks: 50 (Internal Assessment: 10, Semester Exam: 40)

Total Practical Period: 60 hours

Programming in Basic

1. Write a program in Basic to find the largest side of a triangle where the three sides are given as input. First of all you have to check whether the three sides can form the triangle and then you have to find the largest side.

2. Write a program in Basic to find the area of a triangle using Hero's formula. The three sides are given as input. First of all you have to check whether the three sides can form a triangle and then you have to calculate the area of the triangle.

3. Write a program in Basic to check whether a right angle triangle is possible by the three sides given as input. First of all you have to check whether the three sides can form a triangle and then you have to check the condition for right angle triangle.

4. Write a program in BASIC to input an integer and print all its divisors at the output.

5. Write a program in BASIC to input 10 random numbers. Print all the odd numbers at the output.

6. Write a program in BASIC to input 10 random numbers. Print all the even numbers at the output.

7. Write a program in BASIC to find all the prime numbers from 1 to 100.

8. Write a program in BASIC to calculate the sum of 10 natural numbers.

9. Write a program in BASIC to calculate factorial of "N" where "N" is given as input.

10. Write a program in BASIC to input two numbers and calculate their L.C.M.

11. Write a program in BASIC to input two numbers and calculate their H.C.F.

12. Write a program in BASIC to input 10 numbers and print the numbers at the output in ascending order.

13. Write a program in BASIC to input 10 numbers and print the numbers at the output in descending order.

14. Write a program in BASIC to input 10 numbers and arrange the numbers in reverse order and print both the original order and reverse order in two columns at the output.

15. Write a program in BASIC to print 10 Fibonecci numbers at the output where $T(1) = 0$ and $T(2) = 1$.

16. Write a program in BASIC to input a temperature in Celsius scale and convert it into in Fahrenheit scale.

17. Write a program in BASIC to input a temperature in Fahrenheit scale and convert it into in Celsius scale.

18. Write a program in BASIC to input the radius of a sphere in centimetre and calculate its area and volume.

19. Write a program in BASIC to input a five digit number. Construct a new number where the digits are arranged in reverse order and print both five digit numbers at output.

20. Write a program in BASIC to input a five digit number. Construct a new number where the digits are arranged in ascending and descending order and print both five digit numbers at the output.

21. Write a program in BASIC to input the focal length of a convex lens. If the object distance is given, calculate the image distance.

22. Write a program in BASIC to input five resistances. Calculate the equivalent resistance when they are in parallel combintion.

23. Write a program in BASIC to print the first 10 terms of the following series.
0, 3, 8, 15, 24, 35.....

24. Write a program in BASIC to input the number of days and convert it into year, month and day.

25. Write a program in BASIC to find all the three digit numbers for which sum of the cube of the digits is equal to the number itself.
e.g. $153=1^3+5^3+3^3$ (Armstrong number)