"Education through self-help is our motto " - KARMAVEER
Rayat Shikshan Sanstha's
DAHIWADI COLLEGE, DAHIWADI
Tal. Man, Dist. Satara : 415 508
[Arts, Science, Commerce, BCA, B.Voc.Agri.,
Bank Management, Defence Studies & Vocational Education]
Estd : 1965
Jr.College No. J-21.06.001
M.C.V.C. No. J-21.06.901
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Prin. Dr. Suresh T. Salunkhe
[M.Sc.,Ph.D.,M.B.A.]
Founder : Padmabhushan Dr. Karmaveer Bhaurao Patil D.Litt.
[NAAC Third Cycle Reaccredited 'A' Grade (with CGPA 3.25)]
(Affiliated to Shivaji University, Kolhapur) Web. : www.dahiwadicollege.in E-mail : dcdprincipal@gmail.com

Bachelor of Science (B.Sc.)

(Department of Physics)

Programme Outcomes (PO's)

After completing B.Sc. programme the student will be able to:

PO1: Bachelor of Science offers theoretical as well as practical knowledge about different special subject areas.

PO2: This course forms the basis of science for coherent understanding of the academic field to pursue multi and interdisciplinary science careers in future. These subject areas include, Chemistry, Physics, Botany, Zoology, Mathematics, Microbiology and Computer Science.

PO3: Able to plan and execute experiments or investigations, analyze and interpret data information collected using appropriate methods.

PO4: It helps to develop scientific temper, attitude and thus can prove to be more beneficial for the society as the scientific developments and make a nation or society to grow at a rapid pace through research.

PO5: Think critically, follow innovations and developments in science and technology.

PO6: Understand the issues of environmental contexts and sustainable development.

PO7: Acquire the skills and ability to engage in independent and life-long learning in the broadest context socio technological changes.

PO8: To demonstrate professional and ethical attitude with enormous responsibility to serve the society.

DEPARTMENT OF PHYSICS:

Program Specific outcome

PSO1: Discuss the fundamentals laws of Physics and describe the motion of bodies ,

under influence of system forces.

PSO2: Describe the fundamental theory of nature of small scale and energy levels of atomandsub atomic particles.

PSO3: Analyze the applications of mathematics to problems in physics and development ofmathematical methods.

PSO4: Use mathematics to problem in physics and development of mathematical methodsuitable for such applications and for formulation of physical theories.

PSO5: Design small projects as per requirement.

PSO6: Choose appropriate materials for experiments with reference to required results.

Course outcomes(COs)

After successfully completing this course students will able to,

Physics Paper I: Mechanics – I (DSC 1A)

CO1: Describe the scalar product and vector product and state properties of it.

CO2: Examine various vector related problems using vector algebra.

CO3: Find the degree and order of any differential equation.

CO4: Examine given second order differential equation and recommend suitable solution For it.

CO5: Restate the Newton's laws of motion and distinction between inertial and non-inertialframe of references and illustrate it with routine life experiences.

CO6: Analyze the situation on basis of Newton's laws of motion and suggest solution for it.

CO7: Restate and explain the conservation theorems of linear momentum, angular momentum and energy for a single particle and system of particles.

CO8: Explain the rocket motion and solve related problems.

CO9: Discuss the motion of spherical Shell and solid cylinder rolling down an inclined plane.

Physics Paper II: Mechanics II (DSC 2A)

CO10: Restate Newton's law of gravitation, Conservation laws for a particle in central force field, Kepler's Law, Applications of Satellite in circular motion, Idea of GPS, Concept ofweightlessness.

CO11: Determine speed and period of satellite, acceleration due to gravity at height 'h'.

CO12: Assess Kinetic energy, Potential energy, Total energy and their time averages.

CO13: Construct and solve second order differential equations to determine solutions for Simple harmonic motion, damped oscillations and forced oscillations.

CO14: Define Stress, Strain, Young's modulus, modulus of rigidity, Bulk modulus, poisonsratio and state Hooke's law.

CO15: Calculate bending moment of a rod, depression in a cantilever, twisting couple on acylinder, work done in twisting a wire.

CO16: Determine rigidity modulus for a torsional pendulum, Determine Moment of Inertia oftorsional pendulum

CO17: Use searls method to determine Y, □ and □.
CO18: Revise Surface tension, Surface energy, Angle of contact, wettability, Applications of Surface tension.
CO19: Inspect relation between surface tension, excess of pressure and radius of curvature.
CO20: Construct experiment to determine surface tension by Jaegers method.

Physics Laboratory DSC-A Lab: Mechanics
CO21: Use of vernier caliper, screw gauge and travelling microscope to measure length of given objects.
CO22: Determine the Moment of Inertia of of disc using auxillary annular ring a flywheel.
CO23: Determine 'g' by Bar pendulumand Kater' spendulum
CO24: To determine Y of bar by vibration., Y/□ of wire by Searls method, modulus of rigidityof wire by torsional oscillations and poisons ratio for rubber using rubber tube.
CO25: Study motion of spring and calculate spring constant and value of g.

Physics Laboratory DSC-B Lab: Electricity and Magnetism.
CO26: Use of multimeter to measure resistance,AC and DC voltages, DC current and Check ingelectrical fuses.
CO27: Compare the capacities of given condensers by De Sauty's method.
CO28: Study the impedance , resonant frequency, quality factor of series LCR circuit.**CO29:** Measurement of constants of B. G.
CO30: Determine high resistance by leakage method.
CO31: Verify Thevenin's and Norton's theorem.
CO32: To study Parallel LCR circuit to determine its anti-resonant frequency and quality factor.
CO33: To determine frequency of AC mains by sonometer.

Physics Paper III Electricity and Magnetism I. (DSC B1)
CO34: Apply surface, line, volume integral to vector fields
CO35: State gauss divergence and stokes theorem.
CO36: Derive potential due to point charge.
CO37: Assess electric field from potential
CO38: Derive expression for energy per unit volume in electrostatics
CO39: Illustrate gauss's theorem in electrostatics
CO40: Explain working of parallel plate capacitor completely filled with dielectric.

Physics Paper IV: Electricity And Magnetism-II (DSC B2)
CO41: Relate the concepts of Reactance, Impedance, Admittance, and Susceptance. **CO42:** Inspect the LCR series circuit and solve problems related to resonant frequency.
CO43: Analyze the Owen's Bridge and design it as per requirement.
CO44: State the Biot-Savart's law and discuss its applications to straight conductor, circularcoil, solenoid carrying current.

CO45: State the Ampere's circuital law and describe the various Magnetic properties of materials.
CO46: Compare the properties of dia-, para- and ferro-magnetic materials and classify them.
CO47: Restate Faraday's laws of electromagnetic induction, Lenz's law.
CO48: Explain the concept of self-inductance and mutual inductance and solve problems related to it.
CO49: Discuss the Equation of continuity of current and write the Maxwell's equations.
CO50: Explain the electromagnetic wave propagation through vacuum and isotropic dielectric medium.
CO51: Discuss the transverse nature of Electromagnetic waves.

Physics Paper V: Thermal Physics and Statistical Mechanics – I (DSC C1)
CO52: Write the four laws of thermodynamics.
CO53: Classify various thermodynamic processes with suitable examples.
CO54: Explain the concept of thermodynamic equilibrium.
CO55: Solve the problems related to work done during thermal and adiabatic processes
CO56: Inspect the Carnot's cycle and solve problems related to efficiency of it.
CO57: Discuss the concept of entropy with its physical significance and solve the examples of Entropy changes in reversible & irreversible processes.
CO58: Recall mean free path, molecular diameter, Maxwell's law of distribution of velocities, law of equipartition of energy.
CO59: Solve differential equations and derive expression of coefficient of viscosity, thermal conductivity of gas, Diffusion of gas.
CO60: State working principle of various types of thermometers and Recommend them as per requirement.
CO61: Compare working and temperature measurement techniques used in mercury thermometer, Platinum resistance thermometer, thermistor as thermometer and Thermocouple as thermometer.

Physics Paper VI : Waves and Optics (DSC C2)
CO62: Explain the simple harmonic motion, nature of wave motion, behavior of light in various medium.
CO63: Acquire skills to identify and apply formulas of optics and wave physics
CO64: Classify normal modes and normal Co-ordinates, study modes of oscillation of two coupled pendulums and to measure the normal mode frequencies.
CO65: Explain the use of Lissajous figures and compose Lissajous figures of different shapes.

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CO69: Explore how humans perceive sound as a basic principle in acoustic design.
CO70: Explain various vacuum pumps and Recommend them as per requirement.

Physics Paper VII: Thermal Physics and Statistical Mechanics –II(DSC D1)

CO71: Discuss the concepts of thermodynamics potentials, Enthalpy, Gibbs, Helmholtz, Internal Energy functions. Derive the Maxwell's thermodynamical relations and TdS equations.
CO72: Explain the Clausius- Clapeyron equation and Justify the use for various phase changes.

CO73: Illustrate the Joule-Thomson effect and Solve the problems related to (CP – CV) and CP/CV.
CO74: Discuss the Blackbody radiation and its importance, Experimental study of black body radiation spectrum. Describe the Concept of energy density, Planck's law and Wien's distribution law.
CO75: Explain the Rayleigh-Jeans Law, Stefan Boltzmann Law and Wien's displacement law from Planck's law.
CO76: Describe phase space, micro and macrostates, accessible microstates.
CO77: State MB distribution laws.
CO78: Determine alpha and beta in MB distribution
CO79: Illustrate B. E and F. D statistics to gases
CO80: Compare and contrast M. B, B. E and F. D statistics.

Physics Paper VIII: Waves and Optics (DSC D2)

CO81: Explain the cardinal points of an optical system.
CO82: Construct the graphical construction of image using cardinal points.
CO83: Find the resolution, resolving power of optical instruments.
CO84: Compare and contrast between resolution and magnification also explain resolving power of plane diffraction grating and prism.
CO85: Describe the idea of polarization, double refraction.
CO86: Discuss construction, working of Nicol prism and analyze the production and detection of circularly and elliptically polarized light.
CO87: Inspect the situation and justify which phenomena concern to it out of Polarization, Interference and Diffraction of light.

CO88: Solve the Problems related to wavelength of light using diffraction grating.
CO89: Examine the theory of plane diffraction grating, Fresnel's half period zone Zone plate and Fresnel's diffraction at a straight edge.

Physics Laboratory Thermal Physics and Statistical Mechanics I(DSC C1)
CO90: Determine the value of Stefan's constant.
CO91: Study the variation of thermo e.m.f across two junctions of a thermocouple, to record and analyse cooling temperatures of hot objects as function of time using thermocouples
CO92: Determine coefficient of thermal conductivity of Copper by Searls method, Cu by Armstrong method and a bad conductor by Lee's method
CO93: To determine temperature coefficient of resistance by Platinum resistance thermometer.
CO94: Callibrate resistance temperature device using null method / off balance bridge.

Physics Laboratory Thermal Physics and Statistical Mechanics II (DSC C2)
CO95: Determine Temperature coefficient of resistance using thermometer, specific heat of graphite, ratio of specific heat of air by Kundt's tube.
CO96: Examine Temperature of flame, Coefficient of thermal conductivity of glass in form of tube, thermal conductivity of metal bar by forbe's method.
CO97: Calculate Mechanical equivalent of Heat by Callender and Barnes constant flow method.
CO98: Verify Stefan's fourth power law.

Physics Laboratory Wave and optics I (DSC D1)
CO99: Investigate the motion of coupled oscillators.
CO100: Determine frequency of electrically maintained tuning forks by Meld's experiment toverify λ^2- T law,
CO101: Study the Lissajous figures by using CRO.
CO102: Examine coefficient of viscosity of water by capillary flow method and viscosity of liquid by Searls viscometer
CO103: Calculate Velocity of sound using Kundts tube and audio oscillator phase shift method and by resonating bottle.
CO104: Determine frequency of crystal oscillator.

Physics Laboratory Wave and optics II (DSC D2)
CO105: Determine the resolving power of prism and plane diffraction grating
CO106: Examine the wavelength of sodium light using Newton's ring and diffraction due tostraight edge.
CO107: Find thickness of thin film using interference in wedge shaped thin film.
CO108: Using Goniometer to study cardinal points and equivalent focal length of a Optical system and Study angle of specific rotation of sugar using polarimeter.

Physics Paper IX: Mathematical Physics (DSE E1)

CO109: Identify order and degree of partial differential equation.

CO110: Determine linear and nonlinear form of partial differential equation.

CO111: Solving Two dimensional Laplace's and Wave equation and Three dimensional Laplace's equation in Cartesian coordinate system by method of separation of variables

CO112: Inspect second order linear differential equation to determine its singular point.

CO113: Illustrate Frobenious method to second order linear differential equation to determineits solution.

CO114: List standard form of Gamma, Beta and Error functions.

CO115: Outline properties of Gamma, Beta and Error functions CO116: Explain the types of Complex numbers

CO117: Perform algebraic operations on Complex numbers.

CO118: Use Cauchy-Riemann conditions to complex functions.

Physics Paper X: Quantum Mechanics (DSE E2)

CO119: Use the Schrödinger equation, Heisenberg's uncertainty principle, and the Pauli principle to calculate and analyse systems that illustrate quantum mechanical phenomena.

CO120: Solve examples to explain the quantization of energy, superposition, wave-particleduality, and tunneling effect.

CO121: Discuss the basic principles of quantum mechanics.

CO122: Explain the operator formulation of quantum mechanics.

CO123: Discuss the concept of wave function.

CO124: Solve Schrodinger equation for simple potentials.

CO125: Acquire mathematical skills require developing theory of quantum mechanics

CO126: Compare and contrast the differences between classical and quantum mechanics.

CO127: Discuss the postulates of quantum mechanics and apply them to solve some quantummechanical problems.

Physics Paper XI: Classical Mechanics and Classical Electrodynamics (DSE E3)

CO128: Derive the Poisson and Laplace equation and give its physical significance.

CO129: Describe the Motion of charged particle - in uniform electric field E, magnetic field B,Crossed uniform electric field E and magnetic field B.

CO130: Solve problem related to Motion of charged particle - in uniform electric field E,magnetic field B, Crossed uniform electric field E and magnetic field B.

CO131: Define and understand basic mechanical concepts related to advanced problemsinvolving the dynamic motion of classical mechanical systems.

CO132: Explain about the forces, angular momentum and knowledge about the constraint.

CO133: Compare and contrast the differential equations and other advanced

mathematics inthe solution of the problems of mechanical systems.

CO134: Describe and understand the motion of a mechanical system using Lagrange-Hamilton formalism.

CO135: Describe and understand the motion of the forces in non inertial systems.

CO136: Recall inertial frame of reference, non-inertial frame of reference.

CO137: Apply Galilean and Lorentz transformations to frames of references.

CO138: Construct expressions for time dilation, length contraction, variation of mass withvelocity, mass energy equivalence using Special Theory of relativity.

CO139: Discuss Michelson Morley Experiment.

Physics Paper XII: Digital and Analog Circuits and Instrumentation (DSE E4)

CO140: List basic logic gates and Derived logic gate.

CO141: Explain De Morgan's theorem and use of NAND and NOR gate as universal buildingblocks.

CO142: Discuss single stage common emitter amplifier with ac and dc load line.

CO143: Solve the problems related to oscillators (frequency calculation) and amplifiers(related to open loop and closed loop gain).

CO144: Design different types of oscillator circuits of desired frequency.

CO145: Compare types of feedback on basis of it's advantages and disadvantages.

CO146: Explain construction and working of CRO.

CO147: Discuss various applications of CRO and illustrate with suitable examples.

CO148: Describe various applications of operational amplifier.

CO149: Solve problems related to calculation of frequency, time period, pulse width, dutycycle of IC-555 monostable and astable multivibrator.

CO150: List different characteristics and parameters of operational amplifier.

Physics Paper XIII: Nuclear and Particle Physics (DSE F1)

CO151: List Constituents of nucleus and their intrinsic properties, Quantitative facts about size, mass, charge density (matter energy), binding energy, average binding energy and itsvariation with mass number

CO152: Explain Liquid drop model approach, Semi empirical mass formula, Magic numbers

CO153: Discuss Need of accelerators, Cyclotron- construction, working, theory and its limitations, Principle of phase stable orbit, Synchrocyclotron - construction and working, Synchrotrons- electron synchrotron and proton synchrotron, Betatron - principle, construction and working condition

CO154: Compare working of Synchrocyclotron and Betatron

CO155: Construct expression of energy gain.

CO156: Outline - construction, working and theory of Geiger Muller counter, Scintillationdetector and photo-multiplier tube (PMT)

CO157: Explain Semiconductor detector, Cerenkov radiations, Cerenkov detector
CO158: Classify elementary particles
CO159: Inspect, Symmetries and conservation laws energy, momentum, angular momentumand parity, Baryon number, Lepton number of a elementary particle
CO160: Discuss concept of quark model.

Physics Paper XIV: Solid State Physics (DSE F2)
CO161: Classify amorphous polycrystalline and crystalline materials
CO162: Justify SC, BCC, FCC and HCP crystal structure on basis of Co-ordination number, atomic radius, atoms per unit cell and packing fraction
CO163: Outline X-Ray Diffraction technique including Reciprocal lattice and its properties, , Brillouin zone, Diffraction of X-rays by crystals, Ewald construction, Bragg's law in reciprocal lattice
CO164: Explain Experimental methods in X-ray diffraction.
CO165: Use Classical Langevin theory to discuss diamagnetic and paramagnetic materials
CO166: Analysis of cubic crystal by powder method
CO167: Illustrate Weiss theory of ferromagnetism and ferromagnetic domains
CO168: Explain B-H curve, Hysteresis and energy loss
CO169: State density of states, Bloch theorem
CO170: Differentiate between metals, semiconductors and insulators.
CO171: State hall effect Hall voltage and Hall Coefficient.

Physics Paper XV: atomic and molecular physics and astrophysics. (DSE F3)

CO171: Explain normal and anomalous Zeeman Effect.
CO172: Explain anomalous Zeeman effect by vector atom model point of view.
CO173: Compose rotational, vibrational, electronic spectra for molecules.
CO174: Differentiate between Raman and infrared spectra
CO175: Illustrate big bang theory, oscillating theory, hubble law, milky way galaxy.
CO176: Inspect for and against of theories.
CO177: Plot H-R diagram
CO178: Distinguish between sequences of stars.CO179: Explain sunspot cycle

Physics Paper XVI: Energy studies and material science (DSE F4)

CO180: Compare and contrast the types of energy storage systems.CO181: Explain forms of energies and their applications.
CO182: Analyze solar radiations and its measurements. CO183: Explain physics and materials at a deeper level.
CO184: Appreciate that there are relationships and connections between physics and materialsto other science disciplines and understand such relationships and connections in physics.
CO185: Explain wind and bio energy.
CO186: Describe the superconductivity and list type –I and type –II superconductors.
CO187: Discuss the nanoscience and nanotechnology and their application in day to day life.

Physics Laboratory (DSE- E1, E2, E3, E4 and DSF- F1, F2, F3, F4)Group I

CO188: Use resonance pendulum to determine damping coefficient of air
CO189: Examine Surface tension of Soap solution and Mercury.
CO190: Determine Y by Koenig's method and Cornu's method.
CO191: Calculate Y and of given material of Flat spiral Spring.
CO192: Arrange Given set of numbers in Ascending/ Descending order and Find largest andsmallest number from given set of numbers using C programming.
CO193: Use SCILAB to determine eigen values and eigen vectors and to determine Inverse ofa matrix.

Group II

CO194: Trace cardinal points by Turn table and Newton's method.
CO195: Illustrate Brewster's law to find refractive index of a glass.
CO196: Examine Diffraction at single slit and at cylindrical obstacle.
CO197: Determine wavelength of monochromatic source using LLloyd's single mirror.
CO198: Study refractive indices for extra ordinary and ordinary rays for given prism.
CO199: Investigate diameter of Lycopodium powder.
CO200: Plot Caustic curve for a given thick plano convex lens to determine ratio of transverseaberration of extreme rays to radius of least confusion.
CO201: Study absorption spectrum of given liquid Solution.

Group III

CO202: Assess self-inductance by Owen's bridge and mutual inductance by Ballastic galvanometer.
CO203: Measure BH, BV , and θ by magnetometer method.
CO204: Determine resistance of Ballastic Galvanometer by half deflection method.
CO205: Determine e/m by Thomson's method.
CO206: Callibrate wire by Griffiths method.
CO207: Calculate absolute capacity of condenser.CO208: Plot I-V characteristics of Solar Cell.
CO209: Use p-n junction Diode to calculate Band gap energy of semiconductor.
CO210: Use LED to determine Planck's constant.

Group IV
CO211: Verify truth tables of gates and De- Morgan's theorems with IC- 74 series.
CO212: Design single stage CE using voltage divider bias, astable multivibrator and momostable multivibrator using IC -555 Timer.
CO213: To build and Test Colpitts oscillator and phase shift oscillator using BJT.
CO214: Measure unknown frequency and Determine AC and DC sensitivity of CRO
CO215: Study OP-AMP as an inverting amplifier and as Schmitt trigger.

Group V A Skill Testing Experiments
CO216: Observe and calculate divergence of LASER beam.
CO217: Use schusters method for optical leveling of spectrometer.
CO218: Measure Wavelength of LASER using plane diffraction grating and distance Between two coherent sources using biprism experiment.
CO219: Plot polar graph using photo cell.
CO220: Use Tunnel diode to study quantum tunneling effect.
CO221: Test electronic components.
CO222: Edit Save and Execute given C programmes.

Group V B
CO223: Measure Radius of capillary bore using mercury thread, Phase shift of RC networkusing CRO and resistance of Galvanometer using Kelvin's method.
CO224: Estimate errors.
CO225: Determine Lattice constants using XRD powder pattern.
CO226: Use of half and full adder.
CO227: Simplify digital circuit using Boolean laws.
CO228: Wiring of electric bulb, switch and plug.
CO229: Trace given electronic circuit.
CO230: Assemble electronic circuit using soldering method.

Group IV Assessment of Annual work of a student.
CO231: Complete and certify laboratory journal.
CO232: Prepare study tour report.
CO233: Prepare 2 seminar reports.