DEPARTMENTOFPHYSICS,OSMANIAUNIVERSITY,HYDERABAD
M. Sc. (Physics) and M.Sc. (Appl. Electronics) Courses under CBCS
(witheffectfromtheacademic year 2022–2023)

SEMESTER-I

S.No.	Sub. Code	Paper No.	Subject	Instructions/week	Credits
01	101T	Core Paper-I	Mathematical Physics	3	3
02	102 T	Core Paper-II	Classical Mechanics	3	3
03	103T	Core Paper-III	Quantum Mechanics-I	3	3
04	104T	Core Paper-IV	Electronics	3	3
05	151P+152P	Practicals	C-Programming Lab & Electronics Lab	8	4
06	153P+154P	Practicals	Heat & Acoustics Lab & Optics Lab	8	4
					20

Total Credits: 20

SEMESTER-II

S.No.	Sub. Code	Paper No.	Subject	Instructions/week	Credits
01	201T	Core Paper-I	Electromagnetic Theory	3	3
02	202 T	Core Paper-II	Statistical Mechanics	3	3
03	203T	Core Paper-III	Quantum Mechanics-II	3	3
04	204T	Core Paper-IV	General Solid State Physics	3	3
05	251P+252P	Practicals	C-Programming Lab & Electronics Lab	8	4
06	253P+254P	Practicals	Heat & Acoustics Lab & Optics Lab	8	4
					20

Total Credits: 20

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DEPARTMENT OF PHYSICS, OSMANIA UNIVERSITY
M.Sc. (Physics) - Semester-I Syllabus
(For the batch admitted from 2023-2024 onwards)
Core Paper – I (Common for all Specializations)

CourseCode	CourseTitle	L	T	P	C
P-101T	**MATHEMATICALPHYSICS**	**3**	**0**	**0**	**3**

CourseObjectives:Thiscourseenablesthestudents:

COB1	Tounderstandthebasicconceptsofdifferentialandtransformationmathematicalequations
COB2	Toclassifydifferent typesofmathematicalfunctionsanditsproperties
COB3	Tounderstandimportanceofpowerseries
COB4	TounderstandtheconceptofLaplaceandBesselfunctions
COB5	TounderstandtheconceptofFouriertheorempertainingtophysics-problems.

CourseOutcomes:Afterthecompletionofthiscoursethestudent will be:

COC1	Abletoevaluateconditionsforgeneratingfunctionsandsolutionsofpowerseries
COC2	Abletoapplydifferentlineardifferentialequationstoappliedphysicsproblems
COC3	Abletoidentifytheparametersofdifferent seriesfunctions
COC4	Abletodistinguishbetweenpolynomial,differentialandpartialequations
COC5	AbletoevaluateEigenvaluesformatricesandbasicconceptsoftensors

UNIT–I:(15 Hrs**)**
LinearDifferentialequationswithvariablecoefficients:Legendre’sDifferentialequation: ThePower series Solution–Legendre Functions of the first and second kind –Generating Function-Rodrigue’sformula–OrthogonalProperties–Recurrence Relations.
Bessel’s Differential Equation: Power series Solution –Bessel Functions of First and Second kind-GeneratingFunction –Orthogonal Properties –RecurrenceRelations; Elementsofcomplexanalysis.

UNIT–II:(15Hrs**)**
Beta and Gamma functions – Properties and their relations; **Hermite Differential Equation:** PowerseriesSolution–Hermitepolynomials–GeneratingFunction-Orthogonally–Recurrencerelations-Rodriguesformula.
LaguerreDifferentialequations: ThePowerseriesSolution–GeneratingFunction-Rodrigue’sformula–Recurrence Relations, Orthogonal Properties- Integral representation of Laguerre differentialequations; Green’s function. Partial differential equations (Laplace, wave and heat equations in two andthreedimensions).

UNIT–III:(15 Hrs**)**
FourierTransform: Introduction,InfiniteFourierSineandCosinetransforms–-FourierSineandCosine

transformofderivatives-FiniteFouriertransforms–
ApplicationsofFourierTransforms;**LaplaceTransform:**Introduction,PropertiesofLaplacetransformsInverseLaplacetransformanditsproperties
–InverseLaplacetheorem–Convolutiontheorem.
Matrices– Eigen values- Eigen vectors -Characteristic equation of a matrix- Cayley Hamilton theorem;**Tensors** –Order and rank of the tensors –transformation laws of covariant, contra-variant and mixedtensors – properties of tensors: Addition, subtraction and multiplication of tensors, Outer and innerproducts-contractionoftensorsand quotientlaw

RecommendedBooks:

1. AppliedMathematicsforEngineersandPhysicists–LouisAPipesandLawrenceR.Harvill.
2. MathematicalPhysics–AKGhatak,ICGoyal andSLChua-MacmillanIndiaLtd.
3. VectorandTensorAnalysis–SchaumSeries.
4. MathematicalPhysics–SatyaPrakash

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Core Paper – II (Common for all Specializations)

CourseCode	CourseTitle	L	T	P	C
P-102T	**CLASSICALMECHANICS**	**3**	**0**	**0**	**3**

CourseObjectives:Thiscourseenablesthestudents:

COB1	TostudyInertial Frames,Non-Inertial Frames,PseudoandRotationalFrames
COB2	Tostudythe PrincipleofVirtualworkandD'Alembert's
COB3	TounderstandthebasicconceptofLagrangianandHamilton-Jacobiequations
COB4	Tounderstandtheconceptofcanonical coordinatesandcanonicaltransformations
COB5	TostudytheLagrange andPoisson brackets

CourseOutcomes:Afterthecompletionofthiscoursethestudent will be:

COC1	Abletounderstandthemotionofrigidbodyandimportanceofconservationtheorems
COC2	Abletounderstandtheconceptof four-space,Fourvelocity,andEnergy-momentumvectors.
COC3	Abletounderstandthe LagrangianequationforachargedparticleinElectromagneticfield.
COC4	Abletoidentifydifferenttypesoffrequenciesandmodesofvibrations
COC5	Abletounderstandthetheoryofsmall oscillations.

UNIT- I (15 Hrs)

InertialFramesandGalileanTransforms,Non-InertialFrames,PseudoForces,RotationalFrames,Rotational Transforms and Conservation Theorems, Rotations in terms of Euler Angles-Euler's Equationof motionfora Rigid body

Minkowski space, Space-Time diagrams, World point, World line – relativistic motion and Lorentztransformsasrotationinfour-space,Fourvelocity,Energy-momentumvectorswith fewexamples

UNIT- II(15Hrs)

Constraints, Generalized Coordinates, Principle of Virtual work, D'Alembert's Principle, Lagrange'sequation from D'Alembert's Principle, Examples of Lagrangian Equations: Simple Pendulum, CompoundPendulum, Spherical Pendulum, L-C circuit, Velocity dependent potentials- Lagrangian for a chargedparticlein Electromagneticfield.

Theoryofsmalloscillations,stable,unstableandneutralequilibrium,FreevibrationsofaLinearTriatomicmolecule,Eigenvalueequations,Principalaxistransformation-FrequenciesandNormalmodes

UNIT- III(15Hrs)

Euler-Lagrange Equations, Hamilton’s Principle, Lagrange equation from Hamilton’s principle,Principleof Least Action, Examples of Hamilton equations – motion of a particle in a central force field, projectilemotionofabody,chargedparticlemovinginaelectromagneticfield,CycliccoordinatesandConservationtheorems.

Canonical coordinates and canonical transformations, Conditions for the transformations to be canonical,Generating functions, Lagrange and Poisson brackets, Hamilton’s equations in Poisson bracket form,Hamilton-Jacobi equation,Harmonic oscillatorbyHamilton-Jacobimethod.

ReferenceBooks:

1. ClassicalMechanicsbyH.Goldstein,Poole&Safko(Pearson2002)
2. ClassicalMechanicsbyJ.C.Upadhyaya(HimalayaPublishingHouse)
3. IntroductiontoClassical MechanicsbyTakwale&Puranik (TMH)
4. ClassicalMechanics byRana&Joag(TMH)
5. ClassicalMechanics ofparticlesandRigid Bodiesby KiranC Gupta(New AgeInternationalPublishers)
6. LagrangianandHamiltonianMechanicsbyCalkin(AlliedPublishers2000)
7. LagrangianDynamicsbyD.A.Wells(Schaum’sseries1967)

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DEPARTMENT OF PHYSICS, OSMANIA UNIVERSITY

M.Sc. (Physics) - Semester-I Syllabus

(For the batch admitted from 2023-2024 onwards)

Core Paper – III (Common for all Specializations)

CourseCode	CourseTitle	L	T	P	C
P-103T	**QUANTUMMECHNAICS–I**	**3**	**0**	**0**	**3**

CourseObjectives:Thiscourseenablesthestudents:

COB1	Tostudythe fundamentalsof QuantumMechanics
COB2	Tostudythecommutatingand non-commutatingoperators
COB3	Tounderstandthebasic conceptofquantumpictures
COB4	Tounderstandthe conceptofexactlysolubleandsymmetryproblems
COB5	Tostudytheimportanceofangularmomentum

CourseOutcomes:Afterthecompletionofthiscoursethestudent will be:

COC1	AbletounderstandtheimportanceofHermitianoperatoranditsproperties
COC2	Abletounderstandthe conceptofspace andtimedisplacements.
COC3	AbletounderstandtheHydrogenatomandradialpartoftheSchrodingerequation
COC4	Ableto understandthe commutationrelationsofJanditscomponents
COC5	AbletounderstandC.G.CoefficientsandPauli’smatrices.

UNIT–I

FundamentalsofQuantumMechanics(15hrs):

Linear Vector space, Dirac’s Ket and Bra notation. Eigenvalue equation, Eigenkets and Eigenvalues – Degenerateandnon-degeneratestatesOperators,Hermitianoperatorsandtheirproperties-Commutingandnon-commutingoperators.Matrixrepresentationsofvectorsandoperators–Observableandexpectationvalueofanobservable-Parityoperator,Projectionoperator,thenumberoperatorandsignificance

UNIT–II

ExactlySolvableandsymmetryproblems(15hrs):

The Schrodinger, Heisenberg picture and interaction pictures. Linear harmonic oscillator- Solution byoperatormethod, Hydrogenatom, solution oftheradialpartoftheSchrodingerequation

Space and time displacements –unitary operators of space and time displacements and equations ofmotion. Space inversion and unitary inversion operator - intrinsic parity. Time reversal operator –anti-linearoperator

UNIT–III

AngularMomentum(15hrs):

Orbital Angular Momentum, Commutation Relations involving : $\mathbf{L}^2$**,** L_x, L_y, L_z–Eigenvalues and Eigenfunctions of $\mathbf{L}^2$ – Generalized angular momentum, **J** – commutation relations between J^2 and componentsof **J**. J_+ and J_-- Eigen values of **J**2 and Jz. Matrix representation for J^2 and J^z. Spin angular momentum -Pauli spin matrices and their properties. Addition of angular momenta - Clebsch-Gordon coefficients-Recursionrelations-C-GcoefficientsforJ$_1$= ½,J$_2$= ½, andJ$_1$ =½,J$_2$=1, as examples.

ReferenceBooks:

1. QuantumMechanics byL.I. Schiff
2. AText bookQuantumMechanics:PMMathews and KVenkateshan (TMH)
3. QuantumMechanics byGhatakand Lokanathan(Macmillan)
4. QuantumMechanics byE Merzbacher(John Wiley)
5. QuantumMechanicsbyAruldhas(NewAge International)
6. ModernQuantumMechanicsbySakurai(AddisonWesley

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M.Sc. (Physics) - Semester-I Syllabus

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Core Paper – IV (Common for all Specializations)

CourseCode	CourseTitle	L	T	P	C
P-104T	**ELECTRONICS**	**3**	**0**	**0**	**3**

CourseObjectives:Thiscourseenablesthestudents:

COB1	Tostudythebasicprinciplesofregulated power supply
COB2	Tostudythe conditionsoffeedbackamplifiers
COB3	Tounderstandthecharacteristicsofoperationalamplifiers
COB4	Tounderstandtheconceptof logiccircuits
COB5	Tostudythearchitectureof8085microprocessor

CourseOutcomes:Afterthecompletionofthiscoursethestudent will be:

COC1	AbletounderstandtheimportanceofICregulators
COC2	Abletounderstandtheimportanceofpositiveandnegativefeedbackconditionsinamplifiers
COC3	Abletounderstanddifferenttypesofoscillatorsanditscircuitrydiagrams
COC4	Abletounderstandthedifferentapplicationsofop-amplifiersandtimer IC555circuit
COC5	AbletounderstandSOPandPOSK-maps.Assemblelanguage programmingofmicroprocessor

UNIT– I:(15 Hrs**)**

Regulated PowerSupply: BasicPrincipleofregulatedpowersupply,fixedICvoltageregulatorsusingIC78XXand 79XX, variable ICregulators with LM723

FeedbackinAmplifiers: Theconceptoffeedback,PositiveandNegativefeedback–feedbackgain-AdvantagesofNegative feedbackin amplifiers,

Oscillators: BarkhausenCriterion,RCoscillators:PhaseshiftOscillator,WeinBridgeOscillator,LCOscillators: Hartleyand Collpitts Oscillators.

UNIT– II:(15Hrs**)**

Operational Amplifiers: Characteristics ofIdeal operationalAmplifier,Block diagram ofanICoperationalAmplifier,Analysisofinvertingamplifier,Non-invertingamplifier,Integrator,Differentiator,summingamplifier,Differenceamplifier,Comparator,Logarithmicamplifierandexponentialamplifier, Squarewave,Rectangular waveandTriangularwave generators.
TimerIC555: WorkingofIC555, AstableMulti-vibratorwith IC555.

UNIT–III: (15Hrs**)**

Logic Circuits: Min terms and Max terms, simplification of Boolean equations- sum of products andproduct ofsums-KarnaughMaps(upto4variables),Multiplexer (16:1)andDe-multiplexer(1:4)
Flip–Flops: RS,D,JK andM/SJKflipflopswiththeir truthtables,timingdiagrams.
Counters: AsynchronousandSynchronousCounters,ModulusNCounter,DecadeCounterusingIC7490.
Microprocessor: Introduction to Microprocessors –Architecture of 8085 microprocessor,Instruction set:Datatransferinstructions,ArithmeticLogicandBranchoperations,Interrupts,SimpleAssemblylanguageprogramming:8-bit addition, 8-bit subtraction, 8-bit multiplication.

ReferenceBooks:

1. IntegratedElectronics –MillmanandHalkias.
2. Microelectronics–Millman&Grabel.
3. Digitalprinciplesandapplications-MalvinoandLeech
4. Operationalamplifier–Gayakwad
5. PrinciplesofDigitalElectronics–Gothman
6. DigitalPrinciplesandApplicationsComputerElectronics–Malvino.
7. MicroprocessorsArchitecture,ProgramingandApplicationwiththe8085/ 8080–Gaonkar
8. PulseDigital &SwitchingWaveformsbyMillman andTaub,TMH2001.
9. Fundamentalsofelectronics byJDRyder,Wiley.

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DEPARTMENT OF PHYSICS, OSMANIA UNIVERSITY

M.Sc. (Physics) - Semester-II Syllabus

(For the batch admitted from 2023-2024 onwards)

Core Paper – I (Common for all Specializations)

CourseCode	CourseTitle	L	T	P	C
P-201T	**ELECTROMAGNETICTHEORY**	**3**	**0**	**0**	**3**

CourseObjectives:Thiscourseenablesthestudents:

COB1	Tostudythebasicconceptsof electrostaticpotentialsandMaxwell's fieldequations
COB2	Tostudytheboundaryconditionsof E,D, B and H
COB3	Tounderstandthetheoryofpropagation ofplaneelectromagneticwaves
COB4	TounderstandtheconceptreflectionandrefractionofEMwaves
COB5	Tostudytheelectromagneticradiation

CourseOutcomes:Afterthecompletionofthiscoursethestudent will be:

COC1	Abletoget thesolutionsofLaplaceequationandPoyntingtheorem
COC2	AbletounderstandtheLorentzandCoulombGaugetransformations
COC3	Ableto understandPropagationof EMwaves indielectricandconductingmedium
COC4	Abletounderstandthenormalandanomalousdispersion.
COC5	Abletounderstanddipoleradiationandradiationfromcenter-fedlinearantenna,

UNIT– I:(15 Hrs**)**

Electro-StaticPotentialsandMaxwell'sFieldEquations:

Special techniques for calculating electrostatic potential : Poisson's and Laplace's equations- Solutions ofLaplace's equations for electrostatic potential in Cartesian, spherical and cylindrical coordinates-Multi-pole expansion of the energy of a system of charges in an electrostatic field-The scalar and vectormagnetic potentials. Derivation of Maxwell's equations-General wave equation-Gauge transformations-Lorentz and Coulomb gauges-Momentum, angular momentum and free energies of electromagnetic field-PoyntingTheorem(workenergytheoremin electrodynamics).

UNIT– II:(15Hrs**)**

PropagationofPlaneElectromagneticWaves:

Electromagnetic (EM) waves in unbounded media-EM wave equation for a homogeneous isotropicdielectricmedium-PropagationofplanEMwavesinfreespace-PropagationofEMwavesinhomogeneous isotropic dielectric medium- Energy transmitted by a plane EM wave-Propagation of EMwaveinconducting medium-AttenuationandSkineffect-Energy transmitted–PolarizationofEMwave. Propagation of EM waves inbounded media-Boundary conditions for **E,D,B** and **H** – ReflectionandRefraction ofplane EMwavesatplaneinterfacebetweentwo dielectrics

UNIT–III:(15Hrs**)**

InteractionofElectromagneticWaveswithMatter:

Laws of reflection and refraction-Fresnel’s relations- Reflection (R) and Transmission(T) coefficients - Brewster’sangle-Totalinternalreflection-ReflectionandRefractionofplaneEMwavesatplaneinterface between non-conducting and conducting medium-Metallic reflection and its applications –Dispersionin non-conductors–Normalandanomalousdispersion.

Electromagnetic radiation: Inhomogeneous wave equation for potentials-Retarded potentials, Oscillatingelectric dipole radiation-Oscillating magnetic dipole radiation-Radiation from center-fed linear antenna,Lienard-Wiechert potentials.

ReferenceBooks:

1. ClassicalElectrodynamicsbySPPuri,Tata McGraw-Hill PublishingCo.,Ltd(2000).
2. IntroductiontoElectrodynamicsbyDJGriffiths,Prentice-HallofIndia(1998).
3. ElectricityandMagnetismbyMH Nayfeh andMKBrussel,JohnWileyand Sons(1985).
4. Classical Electrodynamics byJDJackson,JohnWileyand Sons(1999).
5. FoundationsofElectromagneticTheorybyJRRietz,FJMilfordandChristy,NarosaPublishinghouse(1986)
6. EngineeringElectromagneticsbyWHHayt andJABuckTataMc-GrawHill (2001)
7. Electromagnetic waves andRadiatingsystems byECJordanandKGBalmain, Prentice Hall(1968)

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DEPARTMENT OF PHYSICS, OSMANIA UNIVERSITY
M.Sc. (Physics) - Semester-II Syllabus
(For the batch admitted from 2023-2024 onwards)
Core Paper – II (Common for all Specializations)

CourseCode	CourseTitle	L	T	P	C
P-202T	**STATISTICALMECHANICS**	**3**	**0**	**0**	**3**

CourseObjectives:Thiscourseenablesthestudents:

COB1	Tostudythebasicconceptsofstatistical mechanic, phasespaceandensembles
COB2	Tostudythepostulatesandpartitionfunctionsofdifferent ensembles
COB3	TounderstandBose-Einsteincondensationphenomenon
COB4	Tounderstandtheconceptfluctuationsanditsrelatedterms
COB5	Tostudythe Isingmodel andorder-disordertransitions

CourseOutcomes:Afterthecompletionofthiscoursethestudent willbe:

COC1	Abletounderstandthedifferentensemblesandpartitionfunctions
COC2	Abletounderstandthe peculiaritiesofliquidHeliumandsuperfluidityproperty
COC3	AbletounderstandFermiDiracgasandwhitedwarfs
COC4	Abletounderstandclassificationofphasetransitionsoffirstandsecondkind
COC5	AbletounderstandtheIsingmodelanditsapplicationtoferromagneticmaterialsandimportance ofB.W.approximation

UNIT– I:(15Hrs**)**
Relation between thermodynamics and statistical mechanics- Micro states and macro states of a system – Phase space- Ensembles – Mean values and ensemble average – Density distribution in phase space- Liouville's theorem. Apriori probability postulate– Micro canonical, canonical and grand canonicalensembles –Quantization of phase space. Entropy and Probability. Entropy of a perfect gas using microcanonical ensemble-Gibbsparadox-Sackur-Tetrode equation. Equipartitiontheorem.

UNIT– II:(15Hrs**)**
Canonical ensemble- Partition function-Ideal gas, Grand canonical ensemble-Partition function-Ideal gas.Partitionfunctionandthermodynamicquantities-
Translational,rotationalandvibrationalpartitionfunctions.
Ideal Bose-Einstein gas-Energy and pressure of the gas. Bose-Einstein condensation-Liquid Helium, TwoFluidmodel-Phonons,superfluidity.IdealFermi-Diracgas-Energyandpressureofthegas.Whitedwarfs.

UNIT–III:(15Hrs**)**
Fluctuation-mean square deviation-Fluctuations in energy, volume and concentration. Brownian motion-Classification of phase transition-Phase transitions of first and second kind: Ising model, Bragg-Williamsapproximation-One dimensional Ising model an application to Ferro magnetic systems-Order-Disordertransition.

ReferenceBooks:

1. StatisticalMechanicsbySatyaPrakashandJPAgarwal(Pragati Prakashan-2002)

2. StatisticalMechanicsbyGuptaandKumar (PragathiPrakashan-2002)

3. StatisticalMechanicsbyBK AgarwalandMEisner(NewAge International)

4. StatisticalMechanicsbyRKSrivastavaandJ Ashok(PrenticeHall,India)

5. IntroductiontophasetransitionsandcriticalPhenomenaHEStanley(ClarendonPress,Oxford).

6. HeatandThermodynamicsbyZemansky(TMH).

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M.Sc. (Physics) - Semester-II Syllabus

(For the batch admitted from 2023-2024 onwards)

Core Paper – III (Common for all Specializations)

CourseCode	CourseTitle	L	T	P	C
P-203T	**QUANTUMMECHANICS-II**	**3**	**0**	**0**	**3**

CourseObjectives:Thiscourseenablesthestudents:

COB1	Tounderstandtheconceptsofscatteringtheory
COB2	Tostudythe relationshipbetweenphaseshiftandPotential
COB3	Tostudythe differentapproximation methods
COB4	Tounderstandtheconcepttimedependent perturbationtheory
COB5	Tostudytherelativisticquantummechanics

CourseOutcomes:Afterthecompletionofthiscoursethestudent will be:

COC1	Abletoevaluatescatteringamplitudebymeansof Green'sandBorn'sapproximationmethods
COC2	Abletoestablishtheconnectionformula
COC3	AbletounderstandFermi'sgoldenrule
COC4	AbletounderstandKlein–GordonEquationandDirac'smatrices
COC5	Abletounderstandrelativisticparticleincentralpotential

UNIT– I (15hrs):

Scattering Theory: Kinematics of Scattering Process: differential and total cross-section - Asymptoticform of scattering wave function. Scattering amplitude by Green's method. Born approximation methodand screened Coulomb potential and square well potential as examples - Partial wave analysis and phaseshift-OpticalTheorem-Relationshipbetween phaseshiftand Potential.ScatteringbyHard sphere.

UNIT–II(15hrs):

ApproximationMethods:TimeIndependentPerturbationTheory**,**Examplesofharmonicandan-harmonic Oscillators. Degenerate case- Stark effect for H-atom for n=2 level. Variation Method - Heliumatomground state.WKBapproximation method-connectionformulae.

Time Dependent Perturbation Theory: Transition probability- Selection rules for transition. Constantperturbation. Transition probability to closely spaced levels- Fermi's golden rule. Harmonic perturbation-Transitionprobabilityrate.

UNIT–III(15hrs):

Relativistic Quantum Mechanics : Klein –Gordon Equation, Plane wave solution and Equation ofcontinuity,Probabilitydensity-DiracEquation,alpha,beta-matrices,Planewavesolution,significanceof negative energy states. Spin of Dirac particle Relativistic particle in central potential –Total AngularMomentum, Particle in a magnetic field – Spin Magnetic moment, properties of gamma matrices-Dirac'sequationincovariantform.

ReferenceBooks:

1. QuantumMechanicsbyLISchiff
2. AText bookQuantumMechanicsbyPMMathews andKVenkateshan (TMH)
3. QuantumMechanics byGhatakand Lokanathan(Macmillan)
4. QuantumMechanics byE Merzbacher(John Wiley)
5. QuantumMechanicsbyAruldhas(NewAge International)
6. ModernQuantumMechanicsbySakurai (AddisonWesley)

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M.Sc. (Physics) - Semester-II Syllabus

(For the batch admitted from 2023-2024 onwards)

Core Paper – IV (Common for all Specializations)

CourseCode	CourseTitle	L	T	P	C
P-204T	**GENERAL SOLIDSTATEPHYSICS**	**3**	**0**	**0**	**3**

CourseObjectives:Thiscourseenablesthestudents:

COB1	Tounderstandthebasictheoryofcrystalstructure
COB2	Tounderstandthedifferentcrystalgrowthmethods
COB3	TounderstandcrystalImperfections
COB4	Tostudythethermalpropertiesofsolids
COB5	Tostudytheband theoryandsemiconductors

CourseOutcomes:Afterthecompletionofthiscoursethestudent will be:

COC1	AbletounderstandtheconceptofreciprocallatticeandBrillouinzones
COC2	Abletounderstanddefectsandcolorcenters.establishtheconnectionformula
COC3	AbletounderstandFermi'sgoldenrule
COC4	AbletounderstandEinsteinandDebye'stheories
COC5	Abletounderstandelectron,holeconcentrationandbandgapexpressions

UNIT– I :(15Hrs**)**

Crystal Structure and Growth: Introduction to crystal structures **(**Crystal translational vectors, unit cell,Bravaislattices, Crystal systems, Miller indices, Symmetry operations), Point groups, Space groups andtheirnotation.Bragg'slaw,Atomicstructurefactor,GeometricalstructurefactorandDebyeWallerfactor, Concept of reciprocal lattice, Concept and construction of Brillouin zones, Experimental methodsof X-ray diffraction– Laue and Powder methods, Determination of unit cell parameters of a cubic crystal,Elementsofelectron and neutron diffraction.

Crystal growth from solution and melt, growth fromvapour phase, Experimental techniques of growthfrommelt.

UNIT–II:(15Hrs**)**

CrystalImperfections: Classificationofimperfections,SchottkyandFrenkeldefects,expression for their equilibrium concentrations in metals and Ionic crystals, Colour centers and theirmodels,Dislocations-EdgeandScrewdislocations,Dislocationmultiplication,Grainboundaries.

Thermal Properties: Elastic waves in one dimensional array ofidentical atoms, Vibrational modes of adiatomic linear lattice and dispersion relations, Acoustic and Optical modes, Infrared absorption in ioniccrystals, Phonons and verification of dispersion relation in crystal lattices. Lattice heat capacity-Einsteinand Debye theories, Lattice thermal conductivity –Phonon mean free path, Origin of thermal expansionand Gruneisenrelation.

UNIT–III:(15Hrs**)**

Band theory: Introduction to band theory, Bloch theorem, Behavior of electron in periodic potentials,Kronig- Penny model, E vs. K relation, Density of states in a band, Effective mass of an electron,Negativeeffectivemassandconceptofhole,Distinctionbetweenmetals,semiconductorsandInsulators.

Semiconductors: Intrinsic and extrinsic semiconductors, Fermi level, Expressions for electron and holeconcentrationsinIntrinsicandextrinsicsemiconductors.Measurementsofbandgapbyinfraredabsorptionin semiconductors, Hall-effect.

ReferenceBooks:

1. CrystallographyandSolidStatePhysics–A.R.VermaandO.N.Srivastava
2. SolidStatePhysics –A.J.Decker,MacmillianIndianLtd,2003.
3. Introductionto Solid StatePhysics–C.Kittel,JohnWileySons Inc,NewYork
4. SolidStatePhysics-RLSinghal,KedarNath&Ramnath&Co,2006
5. ElementsofSolidStatePhysics–J.P.Srivastava,PrenticeHallIndia,2006.
6. ElementsofSolidStatePhysics--Ali Omar,PearsonEducationInc,2002.

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DEPARTMENT OF PHYSICS, OSMANIA UNIVERSITYREVISEDSYLLABUSFOR M.Sc.(PHYSICS) III SEMESTER

Witheffectfromtheacademic year 2023–2024 onwards

S.No	Papercode	Paper	Papertitle	Instructions Hrs/Week	Credits	Max Marks
1.	P301T	Core Paper-I	ModernOptics	3	3	100*
2	P302T	Core Paper-II	Advancedsolidstatephysics	3	3	100*
SolidStatePhysics(SSP)						
3	P303T/SSP	ElectivePaper-I	BandTheory&electrical Properties	3	3	100*
4	P304T/SSP	ElectivePaper-II	Crystal PhysicsandPhysicsof Phonons	3	3	100*
MaterialsScience(MS)						
5	P303T/MS	ElectivePaper-I	MechanicalPropertiesof materials	3	3	100*
6	P304T/MS	ElectivePaper-II	Thinfilmsandtheirproperties	3	3	100*
Electronics&Instrumentation(E&I)						
7	P303T/EI	ElectivePaper-I	ElectronicInstrumentation	3	3	100*
8	P304T/EI	ElectivePaper-II	EmbeddedSystemsandits applications	3	3	100*
NanoScience(NS)						
9	P303T/NS	ElectivePaper-I	SynthesisandCharacterization ofNanomaterials	3	3	100*
10	P304T/NS	ElectivePaper-II	PropertiesofNanomaterials	3	3	100*
ElectronicsCommunications(EC)						
11	P303T/EC	ElectivePaper-I	8051Microcontroller &its applications	3	3	100*
12	P304T/EC	ElectivePaper-II	DataandComputer communications	3	3	100*
BioPhysics(BP)						
13	P303T/BP	ElectivePaper-I	MolecularandEnvironmental Biophysics	3	3	100*
14	P304T/BP	ElectivePaper-II	Physico-chemicaltechniquesin Biophysics	3	3	100*
CondensedMatterPhysics(CMP)						
15	P303T/CMP	ElectivePaper-I	LatticeDynamicsinCrystals	3	3	100*
16	P304T/CMP	ElectivePaper-II	OpticalPhenomenainSolids	3	3	100*

OptoElectronics(OE)						
17	P303T/OE	ElectivePaper-I	Introductiontooptoelectronics	3	3	100*
18	P304T/OE	ElectivePaper-II	SemiconductorOptoelectronics	3	3	100*
			PRACTICALS			
19	P 305P	V	General Physicslab	4	2	50
20	P 306P	VI	Speciallab	8	4	100
			Seminar		2	50
Total					**20**	**600**

AppliedElectronics(AE)					Credits	Marks
21	P301T/AE	Core Paper-I	DigitalSystemDesign	3	3	100*
22	P302T/AE	Core Paper-II	Digitalsignalprocessingand digitalsignalprocessors	3	3	100*
23	P303T/AE	ElectivePaper-I	Datacommunicationand networking	3	3	100*
24	P304T/AE	ElectivePaper-II	Microcontrollerandapplications	3	3	100*
			PRACTICALS			
25	P 305P	V	Analog/Digital/Microcontroller Lab	8	4	100
26	P 306P	VI	DSPLab	4	2	50
			Seminar		2	50
					20	**600**

Detailsofcreditsandmarks	
Number instructionhours per eachtheorypaperperweek	3
Maximummarks for eachtheorypaper	100(70semester exam+ 30 internal evaluation)
Numberof creditsforeachtheorypaper	3
Numberinstructionhourspereachpracticalpaperperweek	8/4
MaximumMarks pereachpracticalpaper	100/50
Number creditspereachpractical paper	4/2
TotalCreditspersemester	20

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M.Sc.(Physics)-Semester-IIISyllabus

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CorePaper–I(Commonforall Specializations)

CourseCode	CourseTitle	L	T	P	C
P-301T	**MODERNOPTICS**	**3**	**0**	**0**	**3**

CourseObjectives:Thiscourseenablesthestudents:

COB1	Toidentifyconditionsforlasingphenomenon andproperties ofthelaser.
COB2	Toclassifydifferent typesoflaserswithrespect todesignandworkingprinciples.
COB3	Tounderstandthebasicsofhologramsandabletodifferentiatebetweenholographyand Photography.
COB4	TounderstandtheconceptofFouriertransformingpropertiesoflenses.
COB5	To understand the concept of non-linear optical process in which photons of intense incominglaserradiationinteractwitha non-linearmaterial andhowradiation withcorresponding harmonicfrequenciesaregenerated.

CourseOutcomes:Afterthecompletionofthiscoursethestudent will be:

COC1	Ableto evaluateconditionsforlasingphenomenonandproperties ofthelaser.
COC2	Abletoappraisedifferenttypeof laserswithrespecttodesignandworkingprinciples.
COC3	Abletoidentifytheparameterswhichdifferentiatehologramsfromphotographs
COC4	Abletodistinguishbetweenvarioustypesofhologramsandtoanalyzethedifferentparametersofholographic recordingmaterials.
COC5	Abletoevaluateintensitydependentmaterialpropertieslikerefractiveindices,opticalmixing andself-focussingoflight.

Unit I: Lasers: Emission and absorption of Radiation, Einstein Relations, pumping Mechanisms, Opticalfeedback, Laser Rate equations for two, three and four level lasers, pumping threshold conditions, Lasermodes of rectangular cavity, Properties of Laser beams. He- Ne, CO_2 Gas lasers, Excimer laser, Ruby,Nd-YAGlaserand their applications.

Unit II: Holography: Basic Principles of Holography- Recording of amplitude and phase, the recordingmedium, reconstruction of original wave front, image formation by wave front reconstruction, GaborHologram, limitations of Gabor Hologram, Off axis Hologram, Fourier transform Holograms, VolumeHolograms,ApplicationsofHolograms-Spatialfrequencyfiltering.

Unit III: Fourier and Non-Linear Optics: Fourier optics- Thin lens as phase transformation, Thicknessfunction, Fourier transforming properties of lenses, Object placed in front of the lens,Object placedbehindthe lens.

Non-LinearOptics,Harmonicgeneration,Secondharmonicgeneration,Phasematchingcondition,Optical mixing, Parametricgenerationof light, Selffocusingoflight.

RecommendedBooks:

1. OptoElectronics-An Introduction–Wilson&JFBHawkes2nd Edition.
2. IntroductiontoFourieroptics –J.W.Goodman
3. LasersandNon-Linearoptics –B.B. Laud
4. OpticalElectronics –GhatakandThyagarajan.
5. PrinciplesofLasers–O.Svelto
6. LaserfundamentalsSilfvastCambridge

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CorePaper–II(Commonforall Specializations)

CourseCode	CourseTitle	L	T	P	C
P-302T	**ADVANCEDSOLIDSTATEPHYSICS**	**3**	**0**	**0**	**3**

CourseObjectives:Thiscourseenablesthestudents:

COB1	TounderstandtheelectronicpropertiesofmetalsbystudyingtheBrillouinzonesandFermisurfaces.
COB2	Tostudytheeffectofelectricandmagnetic fieldsonFermi surfaces inmetals.
COB3	TounderstandthebasicconceptofDielectricsandMagneticpropertiesofsolidsanddifferent typesofpolarizabilities,ferroelectricsandtheirproperties.
COB4	Tounderstandthe classificationofmagneticmaterialsandthetheoriestoexplain Ferromagnetism,Anti-ferromagnetismandFerri-magnetismandtheirapplications.
COB5	Tostudythesuperconductivityandtheirpropertiesandtounderstandtheoriestoexplainthe superconductivityandtheirapplications.

CourseOutcomes:Afterthecompletionofthiscoursethe student will be:

COC1	Abletounderstandandgaintheknowledgeof electrical,dielectricandmagneticpropertiesof solidsandsuperconductivityanditsapplications.
COC2	AbletoconstructtheBrillouin zonesand Fermi surfaces andtoidentifytheenergybandsin solids.
COC3	AbletodistinguishdifferenttypesofpolarizabilitiesandtheirbehaviorinACfieldsandtoclassifythef erroelectric materials andtheir properties
COC4	Abletoidentifydifferenttypesofmagneticmaterialsandtheirapplications.
COC5	Abletounderstandsuperconductivityitspropertiesandapplications.

Unit I: Electronic Properties: Introduction to band theory of solids. Fermi surface and Brillouin zones.Construction of Fermi surfaces. Extended, periodic and reduced zone schemes. Fermi surfaces in simplecubic, bcc and fcc lattices. Effect of electric and magnetic fields on Fermi surfaces. Anomalous and skineffects.Cyclotron frequency, energy levels and density of states in magnetic field, De Haas-van Alpheneffect.

Unit II: Dielectrics and Magnetic properties of solids: Introduction to Dielectrics, Concept of localfield.Theelectronic,ionicandorientationalpolarizabilities.Clausius-Mosottirelation.Behaviorofdielectricsinanalternatingfield,Classificationofferroelectrics-$BaTiO_3$andKDP.Theoryofferroelectrics,ferroelectrichysteresis.

Originofpermanentmagneticmoment,Spontaneousmagnetization,Weisstheoryofspontaneousmagnetization. Nature and origin of Weiss molecular field, Heisenberg exchange interaction. Spin waves,Ferromagneticdomainsandhysteresis.TheBlochwall,Neel'stheoryofanti-ferromagnetism.Ferrimagnetism,ferrites and theirapplications.

Unit III: Superconductivity: Introduction to type-I and type-IIsuperconductors, Isotope effect, entropy,heatcapacityandthermalconductivity.Energygap,Londonequations,penetrationdepth,Coherence length,CooperpairsandelementsofBCStheory,BCSgroundstate.Giavertunneling,DCandACJosephsoneffects.SQUID, Elementsofhigh temperaturesuperconductorsand applications.

RecommendedBooks:

1. SolidStatePhysics --A.J.Deckker
2. IntroductiontoSolidStatePhysics --Kittel
3. SolidStatePhysics --R.L.Singhal
4. ElementsofSolidStatePhysics --J.P.Srivastava
5. SolidStatePhysics --M.A.Wahab

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M.Sc.(Physics)-Semester-IIISyllabus(Forthe batchadmittedfrom2023-2024onwards)

ElectivePaper–I

CourseCode	CourseTitle	L	T	P	C
P-303T/SSP	**BANDTHEORYANDELECTRICALPROPERTIES**	**3**	**0**	**0**	**3**

CourseObjectives:Thiscourseenablesthestudents:

COB1	Tounderstandingthestructureofcrystalsstructureswithexamples,andthestudyofEnergy versuswavevectorrelations.
COB2	To define Brillouin zones in one, two and three dimensions and how the density of states aredistributedandtounderstandtheenergyversus wavevectorrepresentationsininone,twoand threedimensions.
COB3	Tounderstandthebehaviorofanelectronincellularmethod,APWmethod,Pseudopotentialmethod,OPWmethodandthestudyingthevariationofenergywithmomentumvectorinthe abovementionedmethods.
COB4	Tounderstandthetransportproperties ofsemiconductorsandmetalslimitedby electriccurrent densityJinthepresenceofelectric field.
COB5	Tounderstandtheelectricalconductionfromthehoppingof electronsfromonesite toanother siteinthe crystal.

CourseOutcomes:Afterthecompletionofthiscoursethestudent will be:

COC1	It enables the students to understand the structure of crystals in 1, 2 and 3 dimensions. It alsohelpstounderstandthe variationofenergy(E) of anelectronwithitsmoment vector(K). EvsKvariationisnotlinearbutisdiscontinuous at the boundariesof theBrillouin zonesdefinedas first,second,third etc.separated bycertain valuesof K..
COC2	Abletodeterminethequantitiessuchassuchaselectricalconductivity,current densityforan electroninthe presenceofelectricfield.
COC3	Able to determinetheelectricalconductionisfromthe hoppingofelectronsfromone siteto anothersiteinhoppersorelectrontransfer materials.
COC4	Abletoidentifythephenomenaofconductivityinioniccrystalsareduetothemovement ofions fromone siteto anothersite.
COC5	Abletounderstandthestructures ofα-AgIandβ-alumina unitcellandthe defectspresentintheir structuresandtheproperties of superionicconductors.

Unit I : Band Theory Of Solids : Brillouin zones.- Brillouin zones in one, two and three dimensions.,Density of states, Extended, reduced and periodic zone schemes; Nearly free electron model, Tightbinding approximation and its application to simple cubic lattice, Calculation of energy bands-Cellularmethod,APW method, Pseudo potentialmethod, OPW method.

Unit II : Transport Phenomenon In Metals: The Boltzmann transport equation, Electrical conductivity,Definition and experimental features – The Drude Lorentz theory, The Sommerfeld theory-Calculation oftherelaxationtime,Theelectricalconductivityatlowtemperatures,Matheissen’srule,Thermalconductivity, Wiedemann-Franzlaw,Hall-effect-HallcoefficientandHallangle.

Unit III : Electrical Transport Properties of Insulators : Hopping conduction; Temperature variationof electrical conductivity; Seebeck coefficient; Polarons- small polaron band conduction; large polaronband conduction; small polaron hopping conduction; Mott transitions; Ionic Conductivity-conductivity,mobility,Nernst-Einstein relation; Superionic Conductivity- structure, structures of α-AgI and β-aluminaunitcell;Defects-defectequilibriaand conductivity; Propertiesofsuper ionicconductors

Recommendedbooks

1. PrinciplesofthetheorySolids– Ziman
2. SolidstatePhysics -Singhal
3. SolidstatePhysics–H.C.Gupta
4. ElementarySolidStatePhysics –M.Ali Omar
5. SolidStatePhysics– M.A. Waheb
6. SolidStatePhysics–Kachava,

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M.Sc.(Physics)-IIISemesterSyllabus

(Forthe batch admittedfrom2023-2024 onwards)

ElectivePaper–II

CourseCode	CourseTitle	L	T	P	C
P-304T/SSP	**CRYSTALPHYSICSANDPHYSICSOFPHONONS**	**3**	**0**	**0**	**3**

CourseObjectives:Thiscourseenablesthestudents:

COB1	Tostudythebasiccrystallographicpoint groupsand spacegroupsof crystalstructures.
COB2	TolearnMullikansymbolismandrulesofcrystal symmetry .
COB3	To understandthe conceptofphonons.
COB4	Tolearnphenomenologicaldescriptionofdiffusion.
COB5	Tostudythetheoretical conceptsofionicconductivityindetail.

CourseOutcomes:Afterthecompletionofthiscoursethestudent will be:

COC1	Itenablesthestudentstounderstandthecompleteconceptsofcrystal structureandsymmetry operations.
COC2	Abletodrawcharacteristictables,whichdescribesthecompletesetofirreducible representationsofasymmetrygroup.
COC3	Abletodeterminetheroleofphononsin theconductivityandinteraction processes.
COC4	Abletoidentifydifferenttypesofdiffusionprocesswiththehelpofphenomenologicaltheories likeNernst-Einsteinrelations.
COC5	Abletounderstandtheeffectofdivalentimpuritiesonionicconductivity.

Unit I : Elements of group theory: Introduction to crystallographic point groups, the five platonicsolids,procedureforsymmetryclassificationofmolecules,class,matrixnotationforgeometricaltransformations, matrix representation of point groups, reducible and irreducible representations, greatorthogonality theorem and its consequences, Character tables for C_{2V} and C_{3V} point groups, Mullikansymbolism,Symmetryspecies.
Developmentoftheoreticalformalism,tensors,Physicalpropertyanditstensorialrepresentation.Quotienttheorem, Symmetryin crystals -pointgroupsand space groups.

Unit II: **Phonon Physics** :Theoretical background of lattice vibrations – Phonons and their properties – Crystal momentum – Conservation – Neutron diffraction from phonons – Experimental verification ofdispersion relations – Thermal conductivity – Role of phonons – Thermal conductivity – Normal andUmklapp processes – Photon –Phonon interaction – TO and LO phonons– Lyddane– Sach–Teller's(LST)relation–Applications–Infraredmeasurements,Ramaneffect–Theoryofpolaritons–Experimental measurement.

Unit III:**Diffusion in solids** :Solid state diffusion, Diffusion mechanisms, Self-diffusion, Impuritydiffusion coefficient, Fick's second law, Diffusion coefficient, Experimental determination of diffusioncoefficient, Various methods, Random walk diffusion, Diffusion in a simple cubic structure, Diffusionunder external field, Nernst-Einstein relation, Kirkendall shift. Ionic conductivity, Ionic conductivity ofalkalihalides and effect ofdivalentimpurities onionicconductivity.

RecommendedBooks

1. SolidStatePhysics-G.Burns;
2. IntermediateQuantumTheoryofCrystallineSolids–AlexanderOEAnimalu
3. SolidStatePhysics–H.Ibachand H.Luth
4. FundamentalsofSolidStatePhysics–J.R.Christman,
5. SolidStatePhysics,SolidStateDeviceandElectronics,Kachhava,C.M..
6. SolidStatePhysics–A.J.Dekker
7. Solid State Physics –MAWahab.
8. ChemicalapplicationsofgrouptheoryF.A.Cotton
9. PhysicalpropertiesofcrystalsJ.F.Nye;
10. PhysicsofcrystalsS.BhagavantamandS.Radhakrishna,

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DEPARTMENTOFPHYSICS,OSMANIAUNIVERSITY

M.Sc.(Physics)-IIISemesterSyllabus

(Forthe batch admittedfrom2023-2024 onwards)

ElectivePaper–I

CourseCode	CourseTitle	L	T	P	C
P-303T/MS	**MECHANICALPROPERTIESOFMATERIALS**	**3**	**0**	**0**	**3**

CourseObjectives:Thiscourseenablesthestudents:

COB1	Tostudythe basicdislocations andtheirinteractions.
COB2	Tostudymechanicalbehavior ofmaterials .
COB3	Tounderstandtheconceptofelasticbehaviourofmaterials.
COB4	Tolearnaboutcreepresistant materials.
COB5	Tostudythe deformation ofpolycrystallinematerials.

CourseOutcomes:Afterthecompletionofthiscoursethestudent will be:

COC1	Itenablesthestudentsto understandthecompleteconceptsof dislocationsinmaterials.
COC2	Abletounderstandthe stress-straincurves.
COC3	Abletodeterminetheactivationenergy.
COC4	Abletomeasuremechanicalparametersof materials.
COC5	Abletounderstandthere-crystallization,graingrowthandgrainsixeondislocationmotion..

Unit I: Dislocations: Dislocations - Edge and screw dislocations, Mixed dislocation, Burgersvector and Burgers circuit, Stress field of dislocation, Force on a dislocation, Line tension, Forcesbetween dislocations, Interaction of dislocations, Elastic energy of dislocations, Movement ofdislocations, Glide motion, Slip vector and slip plane, Climb of an edge dislocation, creation ofjogs, - Jogs and kinks, Grain Boundaries, Small angle boundaries – Tiltand twist boundaries,energies.

Unit II: Elastic Behavior of Materials: Mechanical behavior of crystalline materials: Elasticdeformation - Thermo elastic effect, An-elasticity, Relaxation, Plastic deformation. Tensile Test,Mechanical parameters, Hardness (Brinell, Vickers and Rockwell) tests,Pierl's force, Stress – straincurvesofcrystals,Differentstages,Dislocationmechanismsineasyglidestage,Multiplication of dislocations – Frank- Read source, Creep, creep curve, Mechanism of creep,activation energy, Dislocation mechanisms,Creepresistantmaterials.

UnitIII:StrengtheningMechanisms: StrengtheningMechanisms:WorkhardeningorStrainhardening–Degreeofcoldworking,Dislocationmechanisms-creationofPartialdislocationsin f.c.c crystals, sessile dislocations, dislocation locks, dislocation pileups; Deformation of polycrystalline materials; Annealing – Re-crystallization, grain growth, recovery, effect of grain size ondislocationmotion.

<u>RecommendedBooks:</u>

1. MaterialsScienceandEngineering –W.D.CallisterJohn Wiley&Sons

2. PhysicalMetallurgyprinciples –ReedHill,RobertMc-GrawHill
3. ElementsofPhysical Metallurgy –A.G.GuyAddison-Wesley
4. PhysicalMetallurgy –R.W.Cahn.andPeterHaasen,NorthHolland
5. MaterialScience Kakani.S.L,AmitKakaniNewage

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ElectivePaper–II

CourseCode	CourseTitle	**L**	**T**	**P**	**C**
P-304T/MS	**THINFILMSANDTHEIRPROPERTIES**	**3**	**0**	**0**	**3**

CourseObjectives:Thiscourseenablesthestudents:

COB1	Tostudythe basictechniques ofthin filmdepositionand preparation.
COB2	Tolearn aboutvarious typesofgauges.
COB3	Tostudythe thinfilmthickness measurement.
COB4	Tolearnaboutellipsometry.
COB5	Tostudythe propertiesofthinfilms.

CourseOutcomes:Afterthecompletionofthiscoursethestudent will be:

COC1	It enablesthestudentstounderstandthecompleteconceptsofthinfilmpreparation
COC2	Abletomeasurethicknessofthinfilms.
COC3	Abletodeterminedielectricconstantofthinfilms.
COC4	Abletoidentifydifferenttypesof reflection,transmissionandabsorptionbythinfilms
COC5	Abletounderstandthedielectricthinfilmsandtheirproperties.

UnitI

VacuumTechniques&ThinFilmDepositionMethods

Productionofvacuum,vacuum pumps,Oilsealrotary androotspumps,diffusionpumps, turbomolecular pump, cryogenic, cryosorption and getter pumps, measurementofvacuum-varioustypesofgauges,Bourdongauge,Piranigauge,Penninggauge.

Methodsofthinfilmpreparation,thermalevaporation,electronbeamevaporation,pulsedlaser deposition,magnetronsputtering,MBE,Chemicalvapordepositionmethods,Solgelspincoating,spraypyrolysis.

UnitII

ThinFilmFormationandThicknessMeasurement

Nucleation,filmgrowthandstructure-variousstagesinthinfilmformation,thermodynamics of nucleation, nucleation theories, Capillarity model and Atomisticmodelandtheircomparison. Structureof Thin film,rollofsubstrate,rolloffilmthickness,filmthicknessmeasurement-interferometry,ellipsometry,microbalance,quartzcrystaloscillatortechniques.

UnitIII

PropertiesofThinFilms

Electrical conduction in metallic films- Continuous and discontinuous films, conductionincontinuousmetal films,conductionindiscontinuousmetalfilms,Dielectric thinfilms - experimental techniques capacitor preparation and setup, measurement of dielectricconstant,effectoffrequencyandtemperature.Opticalpropertiesofthinfilms–reflection, transmission and absorption by thin films –reflection and transmission by asinglefilm;Applicationsofthin films.

Bookssuggested:

1. Materialsscienceofthinfilms,M.Ohring,Elsevier,2006.
2. Thinfilmfundamentals–A.Goswami,NewAgeInternationalpublishers,2006.
3. Thinfilmphenomena-K.L.Chopra,McGraw–HillBookCompany1969.

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DEPARTMENTOFPHYSICS,OSMANIAUNIVERSITY
M.Sc. (Physics) - Semester-III
Syllabus(Forthe batchadmittedfrom2023-2024onwards)

P 303T/EI

ElectivePaper –I

CourseCode	CourseTitle	L	T	P	C
P-303T/EI	**ELECTRONICINSTRUMENTATION**	**3**	**0**	**0**	**3**

CourseObjectives:Thiscourseenablesthestudents:

COB1	Tostudythe basicmeasurementoferrors.
COB2	Tostudycharacteristicsofinstrumentation system .
COB3	Tounderstandthe conceptofinstrumentationamplifierandattenuators.
COB4	Tolearn aboutsignalgeneration andanalysis.
COB5	Tostudythe electronicmeasuringinstruments.

CourseOutcomes:Afterthecompletionofthiscoursethestudent will be:

COC1	It enablesthestudents tounderstandtheaccuracyandprecision in measurement.
COC2	Abletounderstandtheresponseofthesystem.
COC3	Abletomeasurepowerandvoltagemeasurement.
COC4	Abletoreadoscilloscopemeasurements.
COC5	AbletounderstandLEDandsevensegment displaysystems..

Unit I: MeasurementandError:

AccuracyandPrecision–significantfigures–Typesoferror –Statisticalanalysis-Probabilityoferrors –Limitingerrors.

Performancecharacteristicsofaninstrumentationsystem: Zero,FirstandSecondOrdersystems – Response of first and second order systems to STEP, RAMP and IMPULSE inputs-Frequencyresponseoffirstand second order systems.

UnitII:AmplifiersandSignalConditioning:

Instrumentation amplifiers- Isolation amplifiers- Logarithmic amplifiers-Attenuators-Secondorderactivefilters–Lowpass, Highpass,Bandpass,andBandstop filters-Allpassfilters.Phasesensitivedetector(PSD).

SignalGeneration:

Frequency synthesized signal generator- Frequency divider generator- Function generator – Noisegenerator.**SignalAnalysis:**WaveAnalyzer-Heterodynewaveanalyzer-Harmonicdistortionanalyzer-Spectrumanalyzer-Spectra of CW, AM, FMand PM waves.

Unit III

ElectronicMeasuringInstruments:

Digitalfrequencymeter–Digital voltmeter–Phasemeter–RFpowerandvoltagemeasurement.

DisplayandRecording: MagnetictapeRecorders-Laserprinters–Storageoscilloscope.

Characteristicsofdigitaldisplays:LEDandsevensegmentdisplaysystems.

RecommendedBooks

1. ModernElectronicInstrumentationandMeasurementTechniques– A.O.HelfrickandW.D.Cooper,Prentice HallIndia Publications.
2. InstrumentationDevicesandSystems– C.SRangan,G.R.SharmaandVSVMani,TataMcGrawHillPublications.
3. IntroductiontoInstrumentationandControl–A.K Ghosh–PHIPublications.
4. ElectricalandElectronicsMeasurementandInstrumentation –A.K.Sawhney.
5. TransducersandInstrumentation-D.V.SMurtyPHIPublications.

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DEPARTMENTOFPHYSICS,OSMANIAUNIVERSITY

M.Sc. (Physics) - III Semester

Syllabus(Forthe batchadmittedfrom2023-2024onwards)

ElectivePaper–II

CourseCode	CourseTitle	L	T	P	C
P-304T/EI	**EMBEDDEDSYSTEMSANDITSAPPLICATIONS**	**3**	**0**	**0**	**3**

CourseObjectives:Thiscourseenablesthestudents:

COB1	Tostudythe functionalblockdiagramof microcontroller8051.
COB2	Tostudymemoryand programmingaspectsofmicrocontroller8051 .
COB3	Tounderstandtheconceptof PIC microcontrollers.
COB4	Tolearnaboutinterfacingwithmicrocontroller8051.
COB5	Tostudythe PIDandSteppermotors.

CourseOutcomes:Afterthecompletionofthiscoursethestudent will be:

COC1	It enablesthestudentstounderstandtheworkingofmicrocontroller 8051.
COC2	Abletoprogrammicrocontroller8051.
COC3	Abletointerfacemicrocontroller8051withkeyboard,LED,7-Segmentdisplays.
COC4	AbletomeasureStraingauge.
COC5	AbletounderstandworkingofLVDT; PID andRelaysystems.

Unit I

The8051Microcontroller

Block diagram of the 8051; Program Counter and ROM space, Date Types and Directives, PSWRegister, Register Banks and Stack; **Pin Description**, I/O Programming, Addressing Modes of 8051.Arithmetic instructions and programming: Add, Subtract, Multiplication and Division of Signed andUnsigned numbers; Logical Instruction and Programs- Logic, Compare, Rotate, Swap, BCD andASCII Application Programs; Single Bit Instructions with CY; Jump, Loop and CALL Instructions,Time Delay Generation and Calculation; Timer/Counter Programming, Serial Communication aninterruptsProgramming.

Unit II

PICMicrocontrollers

PIC 16C6X/7X Architecture (PIC 16C61/C71), Registers, Pin diagram, Reset action MemoryOrganization, **Instructions**, Addressing Modes, I/O Ports, Interrupts, Timers, Analog-to- DigitalConverter(ADC).

PinDiagramofPIC**16F8XXFlashMicrocontrollers**,Registers,Memoryorganization,Interrupts,I/OPorts andTimers.

Unit –III

ApplicationsofMicrocontrollers

Interfacingof -LightEmittingDiodes(LEDs),Push Buttons,RelaysandLatches.
Interfacing of - Keyboard, 7-Segment Displays, LCD Interfacing, ADC and DAC with 89C51Microcontrollers.

MeasurementApplicationsof–RobotArm,LVDTandStrainGauges
AutomationandControlApplicationsof–PIDControllers,DCMotorsandStepper Motors.

RecommendedBooks:

1. Microcontrollers –TheoryandApplications –ByAjayV Deshmukh,TMH,2005
2. The 8051 Microcontrollers and Embedded Systems –By Muhammad Ali Mazidi andJaniceGillispieMazidi,PearsonEducation Asia,4th Reprint, 2002
3. The8051Microcontroller-architecture,programming&applications–ByKennethJ.Ayala,PenramInternationalPublishing, 1995.
4. Microcontroller8051byD.KarunaSagar,NarosaPublishingHouse,NewDelhi,2011.
5. DesignwithPICMicrocontrollers-ByJBPeatman,MH,PearsonEducationAsia,2003.

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M.Sc.(Physics)-Semester-IIISyllabus

(Forthe batch admittedfrom2023-2024 onwards)

ElectivePaper–I

CourseCode	CourseTitle	L	T	P	C
P-303T/NS	**SYNTHESIS AND CHARACTERIZATION OFNANOMATERIALS**	**3**	**0**	**0**	**3**

CourseObjectives:Thiscourseenablesthestudents:

COB1	Studytheclassificationofnanomaterials.
COB2	Studythevarioussynthesismethodsof nanomatrials.
COB3	Understandopticalandthermalpropertiesofnanomaterials.
COB4	Understandlithographictechniqueusedinnanomaterials.
COB5	Studyvariouscharacterizationtechniquesfornanomaterials.

CourseOutcomes:Afterthecompletionofthiscoursethestudent will be:

COC1	Abletodemonstratetheconceptsofnanostructuredmaterials,theirsizedependent properties, variousexamplesinzero, one,twoand threedimensions
COC2	Abletosynthesizevariousrouteswhichcouldbebottom-upandtop-downapproaches.
COC3	Abletodevelopskillsinthe preparationof nanomaterialsbyPhysicalandChemical methods
COC4	Abletocomparethelithographictechniquesforthenanomaterialfabricationwiththeother techniques.
COC5	AbletousetheknowledgeofcharacterizationtechniqueswhichincludeX-raydiffractometry andspectroscopyforstudyingmorenovel materials.

Unit –I

Propertiesofnanomaterials:

ClassificationofNanostructuredmaterials,densityofstatesfor0D,1D,2Dand3D,nanoparticles,nano-wires,nano-clusters, quantum wells - Size dependent properties of nanomaterials – optical and thermal properties**Synthesisof nanomaterials-I**

Synthesisroutes: Bottom–UpApproaches,Top–DownApproaches,consolidationofNanopowders

Physical methods: Inert gas condensation, Arc discharge, RF Plasma, plasma organic spraying sputtering andthermal evaporation, laser pyrolysis, ball milling, molecular beam epitaxy, chemical vapour deposition method,electrodeposition.

Unit–II

Synthesisofnanomaterials-II

Chemical methods: chemical nucleation theory for cluster formation, metal nanocrystal synthesis by reduction,solvo-thermal synthesis, photochemical synthesis, electrochemical synthesis, sonochemical routes, liquid-liquidinterface,hybridmethods,solvatedmetalatomdispersion,sol-gel,micellesandmicro-emulsion technology.

Lithographic techniques:AFM based nanolithography, e-beam lithography and SEM based nanolithography,ionbeamlithography, deepUVlithography, X-raybasedlithography.

Unit-III
Characterization methods :**Electron Microscopy** : Introduction , Working of SEM,TEM,AFM, applications.**X-rayCrystallography:**Introduction,Structureofnanomaterials,X-raydiffraction(XRD),Thepowdermethod-Determinationofgrainsize/crystalliteusingScherrer'sformula,DeterminationofCrystallitesizedistribution,Smallangle X-rayscattering(SAXS).
SpectroscopyTechniques: Introduction,Fouriertransforminfraredspectroscopy(FTIR),Ramanspectroscopy,DSC,UV visible spectroscopy.

RecommendedBooks:

1. Textbook of Nanoscience and Nanotechnology-B.S.Murty, P.Shankar, BaldevRaj, BBRathandJamesMurdayUniversitiespress,IIM,MetallurgyandMaterials Science
2. PrinciplesofNanoscience&NanotechnologyM.A.Shah,Tokeer Ahmad,NarosaPublishingHouse.
3. Nanocrystals:Synthesis,PropertiesandApplicationsC.N.Rao,P.J.Thomas,G.U.Kulkarni.
4. Springer HandbookofNanotechnology–Bharat Bhushan.
5. NanomaterialsHandbook– YuryGogotsi.

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DEPARTMENTOFPHYSICS,OSMANIAUNIVERSITY

M.Sc.(Physics)-Semester-IIISyllabus(Forthebatch admittedfrom2023-2024onwards)

ElectivePaper –II

CourseCode	CourseTitle	L	T	P	C
P-304T/NS	**PROPERTIESOFNANOMATERIALS**	**3**	**0**	**0**	**3**

CourseObjectives:Thiscourseenablesthestudents:

COB1	Understandtheelectronicpropertiesofnanomaterials.
COB2	Studythedielectricproperties ofnanomatrials.
COB3	Understandopticalandthermal andmechanical propertiesofnanomaterials.
COB4	Understandconceptofphonons innanomaterials.
COB5	Studyaboutmagnetic nanofluids.

CourseOutcomes:Afterthecompletionofthiscoursethestudent will be:

COC1	Abletoidentifythenanocomposites,nanofillers,theirclassification,propertiesandapplications.
COC2	Abletodevelopskillsinthepreparationofnanocompositessuchaspolymer nanocompositesby Physicaland Chemicalmethods..
COC3	Abletousetheknowledge of synthesistechniquesforstudyingmorenovel materialsandapply indailylifeorfurtherresearch.
COC4	Abletoanalyzethe mechanical propertiesofnanocompositesingeneralandalsowhiletheyare usedindevices.
COC5	AbletousetheknowledgeofcharacterizationtechniqueswhichincludeX-raydiffractometry andspectroscopyforstudyingmorenovel materials.

Unit-I

Electronicproperties:Classification ofmaterials- metal, semiconductor, insulator-bandstructures, brillouinzones, mobility, resistivity, relaxation time, recombination centers, Hall effects, Confinement and transport innanostructures: current , reservoirs and electron channels, conductance, local density of states, ballistic transport,Hoppingtransport,coulomb blockade,diffusive transportand Fockspace.

Unit-II

Dielectricandmagnetic properties: Dielectricproperties:Polarization,Clausius-Mossottirelation,Debye'sequations,ferroelectricbehavior,CurieWeisslaw,Polarons,Dielectricnanofluidsand applications.

Magneticproperties:differentkindsofmagnetisminnature:dia,para,ferro,antiferro,ferri,superpara,andimportant propertiesinrelationtonanomagnetism,magneticnanofluids-characteristicsandapplications.

Unit-III

Optical,thermalandMechanicalproperties:

Opticalproperties:photoconductivity,opticalabsorption&transmission,energygapdetermination,photoluminescence, phosphorescence, electroluminescence.

Thermalproperties:conceptofphonons,thermalconductivity,specificheat,exothermic&endothermicprocesses.

Mechanical properties: tensile testing and tensile strength, breaking strength, plastic deformation, statisticalanalysis of failure data, true stress and strain, bend testing flexural strength and modulus, Brinell's, Viker'shardness-testing,impacttesting –toughness,resilienceand scratchtest.

RecommendedBooks:

1. Textbook of Nanoscience and Nanotechnology-B.S.Murty, P.Shankar, BaldevRaj,BBRathandJamesMurdayUniversitiespress,IIM,MetallurgyandMaterialsScience
2. PrinciplesofNanoscience&NanotechnologyM.A.Shah,Tokeer Ahmad,NarosaPublishingHouse
3. Nanocrystals:Synthesis,PropertiesandApplicationsC.N.Rao,P.J.Thomas,G.U.Kulkarni
4. Springer HandbookofNanotechnology–Bharat Bhushan
5. NanomaterialsHandbook–YuryGogotsi
6. IntroductiontoNanoscienceandNanotechnology–K K Chatopadhayya&Banerjee,PHI
7. IntroductionofNanotechnology-CahrlesP.PooleJrandFranksJ.Qwens
8. PhysicsofMagnetism-S.ChikazmiandS.H.Charap
9. EncyclopediaofNanotechnology–Hari SinghNalwa

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DEPARTMENTOFPHYSICS,OSMANIAUNIVERSITY

M.Sc. (Physics) - Semester-III

Syllabus(Forthe batchadmittedfrom2023-2024onwards)

P303T/EC

ElectivePaper-I

CourseCode	CourseTitle	L	T	P	C
P-303T/EC	**8051MICRO-CONTROLLER&ITSAPPLICATIONS**	**3**	**0**	**0**	**3**

CourseObjectives:Thiscourseenablesthestudents:

COB1	Understandthearchitectureof8051microcontroller.
COB2	Studytheaddressingmodesof8051microcontroller.
COB3	Understandtimerandcounterin8051microcontroller.
COB4	Understandconceptofinterfacingof8051microcontroller.
COB5	Understandprogrammingofserialcommunicationin8051microcontroller

CourseOutcomes:Afterthecompletionofthiscoursethestudent will be:

COC1	Ableto programusing8051microcontroller.
COC2	Abletoprogramtimersandcountersindifferent modesin8051microcontroller.
COC3	Abletoprogramserial communicationRS-232with8051microcontroller.
COC4	Abletoprograminterruptsin8051microcontroller.
COC5	AbletointerfaceLED/LCD;ADCandDACwith8051microcontroller.

Unit-I:ArchitectureofMicrocontroller8051:
Input/outputpins,portsandcircuits,externalmemory,counterandtimer, serialdatainputandoutput, interrupts.
Addressing modes of 8051: immediate and register addressing modes, accessing memory usingvarious addressing modes; unsigned addition and subtraction, unsigned multiplication and division,signed numbers concepts and arithmetic operations. Logic and compare instructions rotate and swapinstructions. Jump,LoopandCall instructions, timedelay generation and calculation; singlebitoperationwith carry; readinginputpinsversus portlatch and I/Oprogramming.

Unit-II:**8051Timer/ Counter,Serial CommunicationandInterruptsProgramming**:
Timer / Counter programming: programming 8051 timers, counter programming, pulse frequencyand pulse width measurements. Basics of serial communication, 8051 connection to RS232, 8051serial communication programming. Interrupts of 8051; programming timer interrupts, programmingexternal hardwareinterrupts, andprogrammingserial communicationinterrupts.

Unit-III:**Interfacingof8051Microcontroller**:Programmableperipheralinterface(PPI)-8255,programming 8255, 8255 interfacing with 8051.Interfacing Key board. Interfacing LED / LCD,InterfacingA/D&D/Aconverters, Interfacingsteppermotor andtemperature sensor.

RecommendedBooks:

1. 8051 Micro controller and Embedded systems by Mazidi andMazidi, Pearson EducationAsia(2002).
2. The 8051 Microcontroller Architecture.Programming and Applications byKennethAyala:PenramInternationalPub(1996).
3. Microcontroller8051byD.Karuna Sagar,Narosa PublishingHouse(2011).
4. The concepts and features of micro controllers (68HC11, 8051, 8096) by Rajkamal:Wheeler Pub(2000).

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M.Sc.(Physics)-Semester-IIISyllabus
(For the batch admitted from 2023-2024 onwards)ElectivePaper-II

CourseCode	CourseTitle	L	T	P	C
P-304T/EC	**DATAANDCOMPUTERCOMMUNICATIONS**	**3**	**0**	**0**	**3**

CourseObjectives:Thiscourseenablesthestudents:

COB1	Understandthedatacommunicationnetworks.
COB2	Studythephysicallayer incommunication.
COB3	Understanddatalinklayeranddifferenttopologies.
COB4	Understandconceptofnetworklayer.
COB5	Understandtransportationandapplicationlayer.

CourseOutcomes:Afterthecompletionofthiscoursethestudent will be:

COC1	AbletocommunicatethroughLANnetwork.
COC2	AbletounderstandtheTCP/IPlayersandtheirfunctions.
COC3	Ableto understandthe flowcontrolanderrorcontrolindatalinklayer.
COC4	Abletounderstandpacketswitchingprinciples.
COC5	AbletounderstandtheHTTPandSNMPprotocol.

Unit I:

DataCommunicationNetworks:
LANs: PANs, MANs, Wireless LANs. Internetworks: WANs, Third-Generation Mobile Phone Networks,RFID and Sensor Networks. Protocol Hierarchies, Connection-Oriented Versus Connectionless Service,Service Primitives, Relationship of Services to Protocols. OSI Model: Functions of OSI layers. TCP/IPModel:TCP/IP layers andtheirfunctions.
The Physical Layer: Analog and Digital transmission, Transmission Impairments, Channel Capacity.Transmission Media:Guided transmission media, Wireless transmission, Wireless Propagation, Line ofsight transmission. Signal Encoding Techniques: Digital Data, Digital Signals; Digital Signal EncodingFormats.DigitalData,AnalogSignals;ASK,PSK,FSK.AnalogData,DigitalSignals;PCM&DM.ErrorDetection&ErrorCorrection:TypesofErrors,ErrorDetection,ParityCheck,Checksum,CRC.

Unit II:

The Data Link Layer: Flow Control, Error control, HDLC. Multiplexing: FDM, STDM. AsymmetricDigital Subscriber Line, xDSL. LANs: Topologies, LAN Protocol Architecture, Layer 2 & Layer 3switches, Virtual LANs. High Speed LANs: Traditional Ethernet, High-Speed Ethernet, IEEE 802.1QVLAN Standard. Wireless LANs: IEEE 802.11 Architecture and Services, IEEE 802.11Medium AccessControl, IEEE 802.11 Physical layer, IEEE 802.11 Security Considerations. WANS: Circuit SwitchingNetworks,CircuitSwitchingConcepts,SoftSwitchArchitecture,PacketSwitchingPrinciples.AsynchronousTransferMode(ATM):ATMarchitecture,ATMLogicalConnections,ATMCells,Transmissionof ATMCells, ATM Servicecategories,ATM AdaptationLayer.

Unit III:

The Network Layer: Principles of Internetworking: Connectionless Internetworking.Internet protocol:IP services, IP datagram format, IP addresses Network Classes, Subnets and Subnet Masks, InternetControlMessageProtocol(ICMP).IPV6:Motivationfornewversion,enhancementsinIPV6overIPV4,

IPV6 structure, IPV6 header, IPV6 addresses, hop by hop option header, fragment header, routing headeranddestinationoptionheader.Multicasting:Practicalapplications,multicastinginaninternetenvironmen t, requirements for multicasting. Routing protocols: Autonomous systems, Approaches toRouting,Open Short Path First (OSPF) ProtocolandBorder GatewayProtocol(BGP).
TransportLayer: ConnectionOrientedTransportProtocolMechanisms: TCPandUDP.
ApplicationLayer: ElectronicMail,SMTPandMIME.InternetDirectory Service:DomainNameSystem(DNS).HypertextTransferProtocol(HTTP).Simple NetworkManagementProtocol(SNMP).

RecommendedBooks

1. DataandComputerCommunications,WilliamStallings[TenthEdition]
2. ComputerNetworks,A.S.Tanenbaum[FifthEdition]
3. DataCommunicationsandNetworking,BehrouzA.Forouzan[FourthEdition]

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DEPARTMENTOFPHYSICS,OSMANIAUNIVERSITY
M.Sc.(Physics)-Semester-IIISyllabus

(Forthe batch admittedfrom2023-2024 onwards)
ElectivePaper –I

CourseCode	CourseTitle	L	T	P	C
P-303T/BP	**MolecularandEnvironmentalBiophysics**	**3**	**0**	**0**	**3**

CourseObjectives:Thiscourseenablesthestudents:

COB1	Understandthestructureandfunction,stabilityofbiologicalmacromolecules(enzyme,protein,lipids,nucleic acidsand biocatalysts. .
COB2	Studythedifferentbiologicalsystemsandbiologicalprocessthroughstatisticalthermodynamic principles.
COB3	Understandtheimportanceof environmentandlife.
COB4	Understandelectromagneticradiationandenvironment; conductanceofheatandtemperature, masstransferetc.
COB5	Understandoptical activityindetail.

CourseOutcomes:Afterthecompletionofthiscoursethestudent will be:

COC1	Abletolearnabout basicfunctions ofmacromolecules.
COC2	Abletounderstandenzymesclassificationofdifferentmodels.
COC3	Abletounderstandthestatisticthermodynamics,entropy,applicationtobiologicalsystem.
COC4	AbletounderstandOpticalactivity: CDandORD,Proteins.
COC5	Abletostudent willabletofamiliarwithenvironmentanditsimportancetohumanbeing.

UnitI:Structure andfunctions of macromoleculesandBiocatalysis:

Structure and function of disaccharides and polysaccharide. Classification of proteins. Primaryand secondary structures of proteins. Chemistry of nucleic acids. DNA duplication. Protein synthesis.Structureandfunctionsoflipids.Classificationofenzymes.Michaelis-Mentenmodelforenzymecatalysed reactions. Lineweaver-Burke plots. Inhibitors- specific and non-specific. Modified Michaelis-Menten model for fully competitive and non-competitive inhibited enzyme catalysed reactions. Enzymespecificity.Enzyme structure and functionrelation.

UnitII: Statisticalthermodynamics:CD&ORD

Statistical thermodynamics: Intramolecular and intermolecular forces, Types of bonds, Debye-Huckeltheory.Statisticalthermodynamicsandbiology.Entropytransferoflivingorganisms.Informationtheory –relationbetweeninformationandentropy.Informationcontentofsomebiologicalsystems.

CD & ORD: Polarisation (basics), nature and origin of optical activity, chiral molecules. Optical rotationand circular dichorism, relation between CD & ORD. Drude’s equation. Moffit’s equation. Cotton effect.Opticalactivityinnative proteinsand conformation.Determination ofhelicalcontent.

UnitIII:EnvironmentalBiophysics

Introduction: Microenvironments, Energy exchange, Mass and momentum transport, conservation ofenergyand mass, continuityin thebiosphere, models,heterogeneityand scale.
Temparature: Typical behavior of atmosphere and soil temperature, Random temperature variation,Modeling vertical variation in Air temperature, Modeling Temporal variation in Air temperature, soiltemperature changes with depth and time, Temperature and Biological Development, Thermal time andcalculation from weather data, Temperature extremes and the computation of thermal time, Normalizationofthermaltime,Thermaltime inrelation tootherenvironmentalvariables.
HeatandMassTransport: MolarFluxes,Integrationofthetransportequations,ResistancesandConductances, RsistorsandConductorsinseries,ResistorsinParallel,CalculationofFluxes.Conductance for molecular diffusion, Molecular Diffusivities, Diffusive conductance of the integuments,Turbulent transport, Fetch and Bouyancy, Conductance of the atmospheric surface layer, conductance forheatand masstransferinlaminarforcedconvection,cylinders,spheres andanimalshapes.
Humans and their environment: Area, Metabolic rate and evaporation, survival in cold environments,windchillandstandardoperativetemperature,survivalinhotenvironments,thehumidoperativetemperature,Comfort, Dosimetryand variable linearenergytransfer.

RecommendedBooks:

1. Essentialsofbiological chemistry-byFairley&Kilgour
2. Molecular Biophysics-bySetlow&Pollard
3. Lifechemistry-Anintroduction toBiochemistry-bySteiner
4. IntermediatePhysicsfor medicineand biology-byRusselK,Hobby
5. BiophysicalChemistry-byAGMarshall
6. AnIntroductiontoEnvironmentalBiophysics–GaylonS.CampbellandJohnM.Norman.
7. Experimental methodsin Biophysical Chemistry -byCNicolau
8. Anintroductiontospectroscopyforbiochemists–byBrown

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DEPARTMENTOFPHYSICS,OSMANIAUNIVERSITY
M.Sc.(Physics)-Semester-IIISyllabus

(Forthe batchadmittedfrom 2023-2024 onwards)
ElectivePaper –II

CourseCode	CourseTitle	L	T	P	C
P-304T/BP	**Physico–Chemical TechniquesinBiophysics**	**3**	**0**	**0**	**3**

CourseObjectives:Thiscourseenablesthestudents:

COB1	Understandphysicochemical techniquessuchasviscosity..
COB2	Studythedifferentbiologicalsystemsandbiologicalprocessthroughstatisticalthermodynamic principles.
COB3	Understandthestudentsfamiliar withsomeseparationtechniquessuchaselectrophoresisand variouschromatographictechniques.
COB4	UnderstandvariousImagingtechniquessuchasFluorescencemicroscope;Ultraviolet microscope;Interferencemicroscope;Polarizingmicroscope.
COB5	Understand phase contrast microscope; electron microscope; scanning probe microscopy – atomicforcemicroscope(AFM),scanningtunnelingmicroscope((STM).scanningnearfield opticalmicroscope(SNOM).

CourseOutcomes:Afterthecompletionofthiscoursethestudent will be:

COC1	Abletolearnabout different techniques inordertogetinformationaboutpolymersand biomolecules.
COC2	Abletounderstandmethodsandtechniqueslike:molecularweight determination,sedimentation andscattering.
COC3	Abletogaintheknowledgeofdifferentseparationtechniques,willunderstandbasicsprinciples, instrumentation,workingandapplicationsinbiologyandmedicine.
COC4	AbletogaintheknowledgeofdifferentImagingtechniques,instrumentation,workingand applicationsin biologyandmedicine.
COC5	Abletounderstandtechniquesusedinbiologicalapplicationsofbio-molecules.

UnitI:Molecularweightdetermination

Viscosity: SpecificandintrinsicviscositiesandtheirdeterminationbyOstwald’smethod.Determinationofmolecularweightfromintrinsic viscosity.

Sedimentation: Theory of sedimentation. Determination of sedimentation coefficient by sedimentationequilibriummethodandsedimentationvelocitymethod.Calculationofmolecularweightfromsedimentationequilibriumand velocitymethods.

Rayleigh’s Scattering: Rayleigh’s equation for scattering for dilute gas. Theory for particles smallcomparedwithwavelengthoflight.Theoryoflargeparticleswithdimensionsapproachingthewavelengthof light.ExpressionfortheparticlescatteringfactorP(ϕ)anditsrelationtoradiusofgyration

Unit-II:Separation Techniques

Electrophoresis: Introduction to Electrophoresis. Principle of electrophoresis. ElectrophoreticMobility(EPM) estimation, factors effecting EPM, Supporting media. Types of electrophoresis - Discelectrophoresis: Isoelectric focusing, Isotachophoresis, Paper electrophoresis, Gel electrophoresis;Capillaryelectrophoresis.Applicationsofelectrophoresisinbiologyandmedicine.

Chromatography: Introduction to chromatography.Principle, Instrumentation, working and biologicalapplications of Column chromatography, liquid chromatography, Thin layerchromatography (TLC),Paper chromatography, Ion exchange chromatography, Gel chromatography, Affinity chromatography,Gaschromatography.

Unit-III:Microscopy

Principle,description,workingandbiologicalapplicationsofFluorescencemicroscope;Ultravioletmicroscope; Interferencemicroscope;Polarizingmicroscope;Phasecontrastmicroscope;Electronmicroscope;Scanningprobemicroscopy–AtomicForcemicroscope(AFM),Scanningtunnelingmicroscope((STM). Scanningnear field optical microscope(SNOM).

RecommendedBooks:

1. Experimentalmethodsinbiophysical chemistry –Nicolau
2. IntermediatePhysics forMedicineandbiology–RusselK,Hobby
3. BasicBiophysics forbiologist–M.Daniel.
4. Molecular Biophysics–RichardB.SetlowandErnestC.Pollard.
5. ElectrophoresisinPractice-ReinerWestermeier.

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M.Sc. (Physics) - Semester-III
Syllabus(Forthebatchadmittedfrom2023-2024 onwards)
ElectivePaper –I

CourseCode	CourseTitle	L	T	P	C
P-303T/CMP	**LATTICEDYNAMICSINCRYSTALS**	**3**	**0**	**0**	**3**

CourseObjectives:Thiscourseenablesthestudents:

COB1	Understandthelatticevibrationsofcrystals..
COB2	Studytheeffect oflatticevibrationsontheintensityofthescatteredradiation
COB3	Understandthemethods ofX-raydiffraction.
COB4	Understandtheoryof smallvibrations.
COB5	TheabsorptionandEmissioninoptical crystalsandphonons.

CourseOutcomes:Afterthecompletionofthiscoursethestudent will be:

COC1	Abletolearnaboutdensityofphonon modes,Normalmodes ofvibration.
COC2	AbletounderstandHamiltonianforlatticevibrationsintheHarmonicapproximation
COC3	Abletogainthe knowledgeofLaue method,Braggmethod andDebye-Scherrermethod.
COC4	Abletogaintheknowledgeof deformationpotentialscattering,piezoelectricscatteringand Frohlichscattering.
COC5	Abletounderstand Hartree-Focktheoryoffreeelectrons-Groundstateenergy,exchange energy, correlationenergy.

Unit-I

Lattice Vibrations of Crystals: The infinite and finite linear crystal, Vibrational modes for linear chainwith basis and in higher dimensions,. - Lattice vibrations in Three dimensions: The equation of motion,Allowedvaluesof k: Densityofphononmodes,Normalmodesof vibration,Energylevels.

GroupTheoryandLatticevibrations:PropertiesofNormalcoordinates,thefrequencyofEigenvaluesandthepolarizationvectors,Time-ReversalDegeneracy.Grouptheoreticalanalysisofthelatticevibrations of a linear crystal- case of one atom per unit cell, case of two atoms per unit cell; Ex: Latticevibrationsof atwo dimensionalcrystalwith symmetry$C^{1}_{4v..}$

Born-Oppenheimer Approximation, Hamiltonian for Lattice Vibrations in the Harmonic Approximation,Normal Modesofthe Systemand Quantization of LatticeVibrations-Phonons.

Unit-II

Effect of lattice vibrations on the intensity of the scattered radiation: The intensity of scattered radiation,effectoflattice vibrations-Einsteinmodel, Normalmode treatment.

Scattering of X-rays: from a single electron, single atom and crystal; Interpretation of Laue equations inReciprocalspace.MethodsofX-rayDiffraction:Lauemethod,BraggmethodandDebye-Scherrermethod.TheoryofNeutronscattering,ElasticNeutronscattering,InelasticNeutronscattering,Applicationsof Neutron scatteringto the studyoflattice Vibrations.

Unit-III

Theory of small vibrations (Classical & quantum mechanical), Harmonic and Anharmonic relaxation insolids,theeffectofimpuritiesonlattice vibrations,TheFranck-Condonprinciple.

The absorption and Emission in optical crystals, Phonons: Properties of phonons and momentum ofphonons; Zero-Phonon (electronic) transitions, Characteristics of Zero-Phonon lines, Phonon-assistedtransitions- Electron–phonon interactions:- The rigid-ion model. Electron–phonon matrix elements formetals,insulatorsandsemiconductors.DeformationPotentialScattering,PiezoelectricScattering,Frohlich Scattering. Polarons.- Deviations from the Franck-Condon Approximation, Deviations from theAdiabatic Approximation-Radiationless Transitions- The Hartree equations, Exchange: The Hartree-Fockapproximation, Hartree-Fock theory of free electrons- Ground state energy, exchange energy, correlationenergy(onlyconcept).

Recommendedbooks

1. PrinciplesoftheTheoryof Solids:J. M. Ziman
2. ElementarySolidStatePhysics:M.A.Omar
3. IntroductiontoSolidStatePhysics: C.Kittel
4. AdvancedSolidStatePhysics:PhilipPhillips
5. TheWaveMechanicsofElectronsinMetals:StanleyRaimes
6. SolidStatePhysics: Neil W.Ashcroftand N.DavidMermin
7. IntroductiontoModernSolidStatePhysics: YuriM. Galperin
8. Solid State Physics: An Introduction to Principles of Materials Science (4^{th} Ed.) : H. IbachandH. Luth
9. Principlesof CondensedMatterPhysics:ChaikinandLubensky
10. SolidStatePhysics,EssentialConcepts:DavidW.Snoke
11. CondensedMatter Physics,M. P.Marder,JohnWiley&Sons, Inc. 2000.
12. Group Theory and its Application to the Quantum Mechanics of Atomic Spectra : E.P.Wigner,(1959), Academic Press
13. QuantumChemistry:.I.N.Levine, (1994),Prentice-Hall of India,Pvt.Ltd.
14. InitioMolecular OrbitalTheory:W.J.Hehre,L.Radom, P.V.R.Schleyer,J.A.Pople,JohnWiley,(1986).
15. ModernQuantumChemistry: A.Szabo andN.S.Ostlund,(1996),Mc-Graw Hill.

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M.Sc. (Physics) - Semester-III
Syllabus(Forthebatchadmittedfrom2023-2024 onwards)

ElectivePaper –II

CourseCode	CourseTitle	L	T	P	C
P-304T/CMP	**OPTICALPHENOMENAANDMOSSBAUEREFFECTS IN SOLIDS**	**3**	**0**	**0**	**3**

CourseObjectives:Thiscourseenablesthestudents:

COB1	Understandtheinteractionofradiationand matterwiththe helpofquantumtheory.
COB2	Studythedielectricandopticalpropertiesofmaterials.
COB3	UnderstandtheKramers-KronigrelationsandPhoton-Phonontransitions.
COB4	UnderstandtheMossbauerEffect.
COB5	Understanddifferent kindsofluminescence.

CourseOutcomes:Afterthecompletionofthiscoursethestudent will be:

COC1	Abletotheprocessesofabsorptionandemissionofradiativefields.
COC2	Abletounderstandprinciplesofmagneto-opticeffectandopticaltransitions
COC3	Abletodifferentiatethedirectandindirect bandgapsemiconductors.
COC4	Abletoanalyzethe Mossbauerspectroscopy,Isomershift andMagnetichyperfineinteractions.
COC5	Abletoexplainenergyleveldiagramsof radiativeandnon-radiativeprocesses.

UNIT-I
InteractionofRadiationwithmatter

ClassicalandQuantumtheoryofradiativefield.TheHamiltonianofachargedparticleinanelectromagneticfield,The interactionbetweenachargedparticleandaradiativefield.Firstorderprocess:- Absorption and Emission of Radiative field; Second order process:- Matrix elements due to H_1andH_2, Effective matrixelement,Transitionratesof Scatteringprocesses.

Relationbetweendielectricandopticalproperties(macroscopictheory),Kramers-Kronigrelations,Absorption of electromagnetic radiation, Photon-Phonon transitions, Interband transitions, Direct andindirect band gap semiconductors - Absorption coefficients. Frenkel and Wannier excitons and theirabsorption, Imperfections - exciton absorption below the band gap, Intra band transitions- Absorptionandreflection inmetals. Hagen-Rubens relation,Magneto-opticeffects: Faradayeffect.

UNIT-II
MossbauerEffect

Resonance fluorescence/Natural and Doppler broadening of lines, Qualitative theory of recoil less gammaray emission, Mossbauer effect, Temperature dependence of recoilless process, Debye-Waller factor,Experimental study, Mossbauer spectroscopy, Quantum mechanical theory of Mossbauer effect, Isomershift,Magnetichyperfineinteractions,Electricquadrupoleinteractions,ApplicationsofMossbauereffect.

UNIT-III

LuminescenceandColorcenters

General considerations of luminescence, exciton, absorption and emission processes of luminescence.Configuration coordinate diagram, Energy level diagram, radiative and non-radiative processes, Decaymechanisms. Effect of doping and efficiency, Energy transfer and charge transfer, Different kinds ofluminescence-Electro luminescence, Photoluminescence and Thermo luminescence. Defects and colorcenters, Differentkindsofcolorcentersin thecontextofluminescencein alkalihalides, Thalliumactivatedalkalihalides, Zinc sulphide phosphors.

Recommendedbooks

1. PrinciplesofTheoryofSolids: Ziman,VikasPublishingHouse, NewDelhi.
2. SolidStatePhysics: G.Burns
3. LuminescenceandLuminescentMaterials:Blasse
4. SolidStatePhysics: Dekker.
5. ElementarySolidStatePhysics:M.AliOmar
6. Crystal Symmetry, Lattice Vibrations, and Optical Spectroscopy of Solids: A GroupTheoretical Approach:BaldassareDi BartoloandRichard CPowell
7. LaserSpectroscopy,BasicconceptandInstrumentation: W.Demtroder,(2004),Springer.
8. Infraredand Raman Spectroscopy:B. Schrader,(1993),John Wiley&Sons
9. Group Theory and its Application to the Quantum Mechanics of Atomic Spectra : E.P.Wigner,(1959), Academic Press

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DEPARTMENTOFPHYSICS,OSMANIAUNIVERSITY
M.Sc. (Physics) - Semester-III
Syllabus(Forthe batchadmittedfrom2023-2024onwards)

ElectivePaper-I

CourseCode	CourseTitle	L	T	P	C
P-303T/OE	**INTRODUCTIONTOOPTOELECTRONICS**	**3**	**0**	**0**	**3**

CourseObjectives:Thiscourseenablesthestudents:

COB1	Understandthefundamentalsof opticaltheories.
COB2	Comparethelight wavepropagationthroughdifferentmedia.
COB3	Understandandidentifytheimportanceofopticalanisotropy.
COB4	Understanddescribetheeffect of external fieldsonlight.
COB5	Understandtheelementaryconceptsofquantumtheoryof optics.

CourseOutcomes:Afterthecompletionof thiscoursethestudent will be:

COC1	Abletodescribethelight givenbydifferentopticaltheories.
COC2	Abletodifferentiatethebehaviorof lightpropagatingthroughdifferentmedia.
COC3	Abletounderstandtheconceptofopticalanisotropy.
COC4	Abletocomparetheeffectofexternalfieldsonlight.
COC5	Abletoexplaintheelementaryconceptsofquantumoptics.

Unit I: Introduction: Ray optics: postulates, differential equation of a light ray; wave optics: postulates,monochromatic waves, elementary waves, eikonal equation; electromagnetic optics: plane waves in adielectric, polarization of light, uniaxial and biaxial crystals, dielectric tensor, birefringence, plane wavesinanisotropicmedia,the phasevelocityandrayvelocity,wave refractiveindex,indexellipsoid.

Unit II: Modulation of light: Index ellipsoid in the presence of an external electric field, electroopticeffect-Kerreffect,Pockelseffect,electro-opticretardation,electro-opticphaseandamplitudemodulation, modulator design considerations, Photoelastic effect, Acousto-optic effect - Acousto-opticmodulation, Raman-Nath and Bragg regimes and their modulators. Magneto-optic effect - Faraday effect,optical activity.

Unit III: Quantum Optics: Quantization of free electromagnetic field - mode expansion, quantization infinite one-dimensional cavity, quantization in unbounded free space, creation and annihilation operators,number states, vacuum fluctuations and the zero-point energy, coherent states - generation and properties,squeezedstates:uncertainityrelation,squeezeoperator,generationofsqueezedstates,entangledstates andtheir properties.

ReferenceBooks:

1. FundamentalsofPhotonics– B.E. A.Saleh andM. C.Teich, wiley,2nd edition.
2. PrinciplesofOptics-M.Bornand E.Wolf,Cambridge universitypress,7th edition.
3. OpticalElectronics-A.GhatakandK.Thyagarajan,CambridgeUniversityPress.
4. Lasers and Electro-optics: Fundamentals and Engineering - Christopher C. Davis,CambridgeUniversityPress, 2nd Edition.
5. QuantumOptics-MarlanO.ScullyandM.Suhail Zubairy, Cambridgeuniversitypress
6. Introductory quantum optics - Christoper C. Gerry and Peter L.Knight, Cambridge UniversityPress.

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ElectivePaper-II

CourseCode	CourseTitle	L	T	P	C
P-304T/OE	**SEMICONDUCTOROPTOELECTRONICS**	**3**	**0**	**0**	**3**

CourseObjectives:Thiscourseenablesthestudents:

COB1	Understandtheconceptofopticaltransitionsinsemiconductormaterials.
COB2	Describethestructuresandworkingofdifferentopticalsources&detectors.
COB3	Understandtocomparedifferent optoelectronicdevices.
COB4	Toidentifytheapplicationsof optoelectronicdevices.
COB5	Analyzetheneedofoptoelectronicintegrateddevices.

CourseOutcomes:Afterthecompletionofthiscoursethestudent will be:

COC1	Abletoexplaintheopticaltransitionprocessesinsemiconductormaterials.
COC2	Abletodifferentiatethedifferenttypeofopticalsources&detectors.
COC3	Abletoidentifydifferentoptoelectronicdevices.
COC4	Abletoevaluatevariedapplicationsof optoelectronicdevices.
COC5	Abletoappreciatetheapplicationsofoptoelectronicintegrateddevices.

Unit I: Optical Processes in Semiconductors: Alloy semiconductors, Electron-hole pair formation andrecombination,radiativeand nonradiativerecombination, band-to-bandrecombination.
Absorption in semiconductors- indirectintrinsictransitions,exciton absorption,donor-acceptorandimpurity-bandabsorption,effectofelectricfieldonabsorption,absorptioninquantumwells,theKramers-Kronigrelations.
Radiation in Semiconductors - Relation between absorption and emission spectra, near band gap radiativetransitions,Augerrecombination,luminescencefromquantumwells.

UnitII: Sourcesanddetectors:
Light Emitting Diodes: Electroluminescent process, choice of LED materials, device configuration andefficiency,LEDstructures:heterojunctionLED,surfaceemittingLED,edge-emittingLED,deviceperformancecharacteristics.
Junction lasers: Operating principle, threshold current, heterojunction lasers, modulation of lasers - rateequations,steadystate solution, mode-lockingof semiconductinglasers.
Photodetectors: Photoconductor, junction photodiodes- PIN photodiodes, phototransistor, Schottky-barrierphotodiode.

Unit III: Optoelectronic Integrated Devices: Optical amplifiers - Erbium-doped, Raman and Brillouinamplifiers, Beam splitters, Direction couplers and switches, bistable optical devices, fiber splicers, fiberconnectors,fibercouplers,fiberoptic sensors,fiberBragggratings.

Optoelectronic Integrated Circuits: Need for integration, materials for optoelectronic integrated circuits(OEICs),frontend photoreceivers,opticalcontrolofmicrowaveoscillators.

ReferenceBooks:

1. Semiconductoroptoelectronicdevices-PallabBhattacharya,PearsonEducation,2ndedition.
2. Semiconductoroptoelectronics:PhysicsandTechnology-J.Singh,McGraw-Hill.
3. Semiconductorphysicsanddevices-DonaldA.Neamen,McGraw-Hill,3rdedition.
4. Integratedoptics:theoryandtechnology-Robert G.Hunperger,Springer,6thedition.
5. Optical Fiber communications: principles and practice – John M.Senior, Pearson Education, 3rdedition.

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P301T/AE

CorePaper -I

CourseCode	CourseTitle	L	T	P	C
P-301T/AE	**DIGITALSYSTEMDESIGN**	**3**	**0**	**0**	**3**

CourseObjectives:Thiscourseenablesthestudents:

COB1	Understandtheconceptof Booleanfunctionsand Booleanalgebra.
COB2	Describethelogicdesignandthedigitalcircuits.
COB3	UnderstandtheworkingofCPLDandFPGA .
COB4	Tounderstandthesequential logicsand counters.
COB5	AnalyzetheTTL,ECL, MOSandCMOScircuits.

CourseOutcomes:Afterthecompletionofthiscoursethestudent will be:

COC1	AbletoexplaintheBooleanalgebra.
COC2	Ableto applylogic designusingadders,subtractors andcodeconverters.
COC3	Abletoidentifydifferentlogicfamilies.
COC4	Abletoevaluatevariedapplicationsofcombinational logic.
COC5	Abletoappreciatetheapplicationsof sequentiallogiccircuitsandcounters.

UnitI:BooleanFunctions: Binary,Octal,HexadecimalNumbers,BinaryCodesandLogics**;**BooleanAlgebra,BasicTheoremsandFunctions,Canonical,DigitalandIntegratedCircuits**;**Simplifications of Boolean Functions, Two to Six Variable Map Simplification, NAND and NORImplementation,Tabulationmethod, DeterminationandSelection ofPrimeImplicants.

Unit II: Logic Design: Combinational Logic –Adders, Subtractors, Code Conversion, MultilevelNAND,NOR andEx-ORfunctions**;** MSI andPLD Components–Decimal, Binary AdderandSubtractor,Comparators,Decoders,Encoders,MuxandDe-Mux,ROM,PLAandPAL**;GAL,CPLD and FPGA.** Over view of Digital Integrated Circuits with all Logic Families – TTL, ECL,MOS, CMOS.

Unit III: Sequential Logics and Counters: Synchronous Sequential Logics – FFs, Analysis, StateReductionandAssignment,FFExcitationTables,DesignProcedureandDesignofCounters**;**Asynchronous Sequential Logics – Analysis, Circuits with Latches, Registers, Shift Registers, Rippleand SynchronousCounter. -

TextBooks:

1. DigitalDesign–M.MorrisMano
2. Switchingtheory&Logic Design–R.P.JainTMH 2003

3. Digital SystemPrinciples&Applications-RonaldJ.Tocci

ReferenceBooks:

1. ComputerArchitectureandLogicDesign–ThomasC.Bartee
2. DigitalPrinciples&Applications–AlbertPaulMalvinoandDonaldP.Leach
3. DigitalComputerDesign–V.RajaramanandT.Radhaknan
4. DigitalElectronics-AnIntroductiontoTheoryandPractice–WilliamH.Gothman
5. DigitalComputerElectronics–A.P.MalvinoandJ.A.Brown
6. DigitalIntegratedCircuits–ADesignPerspective–JanMRabae
7. ICs&Microprocessors–DataHandBook,BPBPublications,India
8. DigitalLogicandMicroprocessors–F.J.HillandG.R.Peterson
9. DigitalCircuitsandMicroprocessors–HerbertTaub
10. SwitchingandFinite AutomataTheory–Zvi Kohavi andNiraj K.Jha
11. Digital Design –John FWakerly

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CorePaper –II

CourseCode	CourseTitle	L	T	P	C
P-302T/AE	**DIGITALSIGNALPROCESSINGANDD IGITALSIGNALPROCESSORS**	**3**	**0**	**0**	**3**

CourseObjectives:Thiscourseenablesthestudents:

COB1	Understandtheconcept ofDiscreteTimeSignal andLinearSystems.
COB2	DescribetheDiscreteFourierTransform.
COB3	Understandtheconcept of Fast-FourierTransform.
COB4	TounderstandtheDesignofDigitalFilters.
COB5	UnderstandthearchitectureofTMS320C5X.

CourseOutcomes:Afterthecompletionofthiscoursethestudent will be:

COC1	AbletoappreciatetheuseofFFTindigitalsignalprocessing.
COC2	Abletoapplyfrequencyanalysisofdiscretetimesignals.
COC3	AbletodesignFIRfilterusingwindows.
COC4	AbletoprogramTMS320C5Xintermsofcentralarchitecturelogicunit(CALU)-auxiliary register(AR)and indexregister.
COC5	AbletoapplypipelininginTMS320C5Xanditsoperation.

UnitI:DiscreteTimeSignalAndLinearSystems–Introduction-AdvantagesofDSP-Classification of Signals-Signal representation-Standard signals discrete –time signals- Operation onsignals Discrete timesystem-Classification of Discrete timesystem- Convolution- Correlation ofTwosequences-InversesystemsandDeconvolution,frequencyanalysisofDiscretetimesignals.

Z-Transform-Introduction–ROC-PropertiesofROC-InverseZ-Transform-DiscreteFourierTransform-DiscreteFourierSeries-Properties-DFT-Properties-Comparisonbetweenlinearandcircular convolution-filteringlongduration sequence.

Unit II:Fast-Fourier Transform- direct evaluation of DFT-Decimation-in-Time and Frequency-Differences and similarities between DIT and DIF-IIR filters- Introduction-Design of Digital Filtersfrom analog filters-Analog low pass filter design-Butterworth-Chebyshev- filters-Design of IIR filtersfromanalogfilters-Frequencytransformationondigitaldomain-realization ofDigital Filters.

FIR Filter- Introduction-Linear Phase FIR filters-their frequency response-Location of the zeros ofLPFIR filters-Fourier series method of designing FIR filter-Design of FIR filter using windows-Frequency sampling method of designing FIR filters-Realization of FIR filters-Finite word lengtheffects in digital filters-Introduction-Rounding and truncation errors-Quantization in A/D signals-Quantizationeffectsinthecomputation ofDFT.

UnitIII:DigitalSignalProcessor-ArchitectureofTMS320C5X-Busstructure-CentralArchitecture logicunit(CALU)-AuxiliaryRegister(AR)-Indexregister(INDX)-ARCR-BlockmoveaddressRegister-BlockRepeatRegister-Parallellogicunit-memorymappedregisters-programcontroller-someflags instatusregister-On-chip memory-On-chipperipherals.

TMS320C5XLanguage-Assemblylanguagesyntax-Addressingmodes-Instructions-Load/Store-Addition/Subtraction-Move-MultiplicationNORM-Programcontrol-Peripheral control.

Instruction Pipelining in C5X-Pipeline structure-Operation-Application programs in C5X-C50 basedDSP starter Kit (DSK)-Programs for familiarization of arithmetic instructions-Programs in C5X forprocessingRealTime signals.

RecommendedTextBooks:

1. DigitalSignalProcessingbyProkaies(PHI)
2. DigitalSignal ProcessingbySanjitKMitra
3. Digital SignalProcessingbyRameshBabu-Sci-TechPub
4. DigitalSignalProcessersbyB.VenkataRamanietal(TMH)
5. DigitalSignal ProcessersbySenMKuoetal–PearsonEducation

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ElectivePaper -I

CourseCode	CourseTitle	L	T	P	C
P-303T/AE	**DataCommunications&Networking**	**3**	**0**	**0**	**3**

CourseObjectives:Thiscourseenablesthestudents:

COB1	Understandtheconcept ofTCP/IPProtocol Architecture.
COB2	Describetheguidedtransmissionmediaandwirelesstransmission.
COB3	Understandtheconcept ofDigital DataCommunicationTechniques.
COB4	Tounderstandthe DataLinkControl Protocols.
COB5	UnderstandtheCircuit SwitchingandPacket Switching.

CourseOutcomes:Afterthecompletionofthiscoursethestudent will be:

COC1	AbletouseOSImodel fordigital datatransmission.
COC2	Ableto applysignalencodingtechniques.
COC3	Abletodesigndataflowcontrol,errorcontrolandHDLC.
COC4	Abletofrequency-divisionmultiplexing,synchronoustime-divisionmultiplexingofdigitaldata.
COC5	Abletoapplyeffectsofcongestion,**c**ongestioncontrolandtrafficmanagement.

UNIT-I

TCP/IPProtocolArchitecture,OSIModel,StandardizationwithinaProtocolArchitecture,TraditionalInternet-BasedApplications, Multimedia.
DataTransmission:AnalogandDigitalDataTransmission,TransmissionImpairments,ChannelCapacity.
Transmission Media: Guided TransmissionMedia,WirelessTransmission,Wireless Propagation,Line-of-Sight Transmission.
SignalEncodingTechniques: DigitalData,DigitalSignals,DigitalData,AnalogSignals,AnalogData,Digital Signals,AnalogData, AnalogSignals.
DigitalDataCommunicationTechniques: AsynchronousandSynchronousTransmission,TypesofErrors,Error Detection,Error Correction,Line Configurations.

Unit-II

Data Link Control Protocols: Flow Control, Error Control, High-Level Data Link Control (HDLC).**Multiplexing:**Frequency-DivisionMultiplexing,SynchronousTime-DivisionMultiplexing,StatisticalTime-DivisionMultiplexing, Asymmetric Digital Subscriber Line,xDSL
CircuitSwitchingandPacketSwitching: SwitchedCommunicationsNetworks,CircuitSwitchingNetworks, CircuitSwitchingConcepts,SoftswitchArchitecture,Packet-SwitchingPrinciples,X.25,FrameRelay.
AsynchronousTransferMode: ProtocolArchitecture,ATMLogicalConnections,ATMCells,Transmission of ATM Cells,ATM ServiceCategories.

Unit-III

Routing in Switched Networks: Routing in Packet-Switching Networks, Least-Cost Algorithms.**CongestionControlinDataNetworks:**EffectsofCongestion,CongestionControl,TrafficManagementCongestionControlinPacket-SwitchingNetworks,FrameRelayCongestionControl,ATMTrafficManagement, ATM-GFRTraffic Management.

RecommendedBooks:

1. WilliamStallings, Data&computercommunications8/ePearsoneducation.
2. BehrouzA.Forouzan, Data communications&networking3/eTMH.
3. FredHasal,Datacommunicationscomputer networkandopensystems4/e Pearsoneducation2005.
4. R.P.Singh,S.D.SapreCommunicationSystems,AnalogandDigital.3/e,McGrawHill.2017.

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ElectivePaper –II

CourseCode	CourseTitle	L	T	P	C
P-304T/AE	**MICROCONTROLLERANDAPPLICATIONS**	**3**	**0**	**0**	**3**

CourseObjectives:Thiscourseenablesthestudents:

COB1	Understandthearchitectureof8051microcontroller.
COB2	Studytheaddressingmodesof8051microcontroller.
COB3	Understandtimerandcounterprogrammingof8051microcontroller.
COB4	Understandconceptofinterfacingof8051microcontroller.
COB5	Understandinterfacingusingaurdino.

CourseOutcomes:Afterthecompletionofthiscoursethestudent will be:

COC1	Ableto programusing8051 microcontroller.
COC2	Abletoprogramtimersandcountersindifferent modesin8051microcontroller.
COC3	AbletointerfaceLCD; ADC;DACandstepper motorwith8051microcontroller.
COC4	Abletoprograminterruptsin8051microcontroller.
COC5	Abletointerfaceusingaurdino.

UnitI:The8051Microcontroller

Microcontrollers and Embedded processors, overview and Block diagram of the 8051; Inside the8051, Assembling and Running an 8051 Program, The Program Counter and ROM space, Date TypesandDirectives,FlagBitsandPSWRegister,RegisterBanksandStack;PinDescription,I/OProgramming, Bit Manipulation; Addressing Modes- Immediate and Register Addressing Modes,AccessingMemoryusingVarious AddressingModes

Unit II:ProgrammingandInterfacing8051

InstructionSet-ArithmeticinstructionPrograms-Add,Subtract,MultiplicationandDivisionofSigned and Unsigned Numbers; Logical Instruction and Programs- Logic, Compare, Rotate, Swap,BCDandASCIIApplicationPrograms;SingleBitInstructionsandProgramming–SingleBitInstructions with CY; Jump, Loop and call Instructions, Time Delay Generation and Calculation;Timer/Counter Programming,Serial Communicationand interruptsProgramming.

Interfacing an LCD, ADC and Sensors with the 8051; Interfacing astepper Motor, Keyboard andDACto generate waveforms on CROwith8051.

Unit III:InterfacingusingAurdino

Types of Arduino boards, Arduino Uno Architecture, Sensors and Actuators, Interfacing of SensorswithArduino-Temperature,Humidity,Motion,UltrasonicSensor,PIRMotionSensor,Light,MoistureSensorandGasSensor.InterfacingofActuators-RelaySwitchandServoMotor,Introductionto NodeMCU.

RecommendedBooks:

1. The8051MicrocontrollersandEmbeddedSystems-ByMuhammadAliMazidiandJaniceGillispieMazidi, PersongEducation ,Asia, 4^{th}Reprint,2002.
2. The8051Microcontroller-Architecture,Programming&Applications–ByKennethJ.Ayala,PenramInternationalPublising, 1995.
3. Microcontroller8051–ByD. KarunaSagar,Narosa PublishingHouse,2011.
4. CProgrammingforArduino,JelienBayle,Packt Publishing,Bermingham,UK.
5. ArduinoMade SimplebyAshwinPajankar, BPBPublications.

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DEPARTMENT OF PHYSICS, OSMANIA UNIVERSITYREVISEDSYLLABUSFOR M.Sc.(PHYSICS)

IVSEMESTER

Witheffectfromtheacademic year 2023-2024 onwards

S.No	Papercode	Paper	Papertitle	Instructions Hrs /Week	Credits	Max Marks
1.	P401T	CorePaper-I	NuclearPhysics	3	3	100*
2	P402T	CorePaper-II	Spectroscopy	3	3	100*
SolidStatePhysics(SSP)						
3	P403T/SSP	Elective-III	OpticalPhenomenainsolids	3	3	100*
MaterialsScience(MS)						
4	P403T/MS	Elective-III	MaterialScience	3	3	100*
Electronics&Instrumentation(E&I)						
5	P403T/EI	Elective-III	Instrumentationformeasurement anddatatransmission	3	3	100*
NanoScience(NS)						
6	P403T/NS	Elective-III	Nanocomposites	3	3	100*
ElectronicsCommunications(EC)						
7	P403T/EC	Elective-III	Mobilecellularcommunications	3	3	100*
BioPhysics(BP)						
8	P403T/BP	Elective-III	Cellandmembrane biophysics	3	3	100*
CondensedMatterPhysics(CMP)						
9	P403T/CMP	Elective-III	TransportPhenomenainsolids	3	3	100*
OptoElectronics(OE)						
10	P403T/OE	Elective-III	FiberOpticTechnology	3	3	100*
PRACTICALS						
11	P 405P	V	General Physicslab	8	4	100
12	P 406P	VI	Speciallab	4	2	50
13			Project		5	150
					20	600

AppliedElectronics(AE)				Marks	Credits	
14	P401T/AE	Core PaperI	Digitalsystemdesign using VHDL	3	3	100*
15	P402T/AE	CorePaperII	FeedbackControl Systems	3	3	100*
16	P403T/AE	ElectivePaper-III	GuidedandUnguidedmedia communication	3	3	100*

	P404/AE	Project			5	150
PRACTICALS						
17	P 405P/AE	V	FiberOpticsCommunication& Microwaves Lab	4	2	50
18	P 406P/AE	VI	VHDLLab	8	4	100

Detailsofcreditsandmarks	
Number instructionhours per eachtheorypaperperweek	3
Maximummarks for eachtheorypaper	100(70semester exam+ 30 internal evaluation)
Numberof creditsforeachtheorypaper	3
Numberinstructionhoursper eachpracticalpaperperweek	8/4
MaximumMarks pereachpracticalpaper	100/50
Number creditsperpractical paper	4/2
TotalCreditspersemester	20

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P 401T

CorePaper- I(Commonforall Specializations)

CourseCode	CourseTitle	L	T	P	C
P-401T	**NUCLEARPHYSICS**	**3**	**0**	**0**	**3**

CourseObjectives:Thiscourseenablesthestudents:

COB1	Understandtheconceptofnuclearforces.
COB2	Studythenuclearmodelsanditsmagneticmoments.
COB3	Understandnuclear decayand nuclear detection.
COB4	Understandconceptofinteractionofchargedparticleswithmatter.
COB5	Understandapplicationsofnuclearphysics.

CourseOutcomes:Afterthecompletionofthiscoursethestudent willbeableto:

COC1	Demonstrate the concepts of nuclear force, nuclear decay processes, detection mechanism andreactions.
COC2	AnalyzetheDeuteronproblem,exchangeforcetheories,α-decay,β-decay,Bethe'sformula Photoelectriceffect,Comptoneffectandpairproduction.
COC3	Understandtheneutrinohypothesis,Bohr'stheory,workingofgammaraydetectors,kinematicsofnucl earreactions, nuclear reactors.
COC4	Evaluatetheimportanceofknowledgeof handlingradioactivematerialsforvariousapplications indaytodaylife likefoodirradiation,radiationtherapyanddiagnosis.
COC5	Develop skills in critical thinking and problem-solving and apply them effectively in bothacademicand professionalcontexts.

Unit I:

Nuclear Forces: Systematics of nuclear force - strength, range, charge independence; Deuteron problemand its contribution to the definition of the Nuclear force. Exchange force theories - Majoranna, Bartlett,Heisenbergand Yukawa.

Nuclear Models: The liquid drop model, the semi empirical mass formula and its applications; The Shellmodel, states based on square well potential and harmonic oscillator potential, Predictions - spins andparitiesof nuclear ground states,magnetic moments,electricquadruplemoments.

Unit II:

Nuclear Decay:α-decay, Gamow's theory, fine structure of α-spectrum, alpha decay, systematics,neutrino of hypothesis, Fermi's theory of β-decay, Fermi-Curie plot, angular momentum, selection rulesforβ-decay,

Nuclear Detection: Interaction of charged particles with matter, Bohr's theory, Bethe's formula. Range-energyrelation,Stoppingpower,Measurementsofrangeandstoppingpower.Interactionofgammarays withmatter-Photoelectriceffect,ComptonEffectandpairproduction;Gammaraydetectionusinggas,scintillationand solid statedetectors.

UnitIII:

Nuclear Reactions: Classification of nuclear reactions, Kinematics and Q-value of reactions; Basictheoryofdirectnuclearreactions-Bornapproximation,strippingandpick-upreactions,Compoundnucleus formation; Theory of Fission and fusion reactions. Nuclear Reactors: Fission reactors - fusionreactors - **ParticlePhysics:**ElementaryParticles,ClassificationandtheirQuantumNumbers(Charge,Spin,iso-spin etc.). Fundamental forces, Conservation of Parity, Strangeness and Lepton and Baryon numbers,**ApplicationsofNuclearPhysics**:Foodirradiation,Medicalphysics-radiationtherapy-radiationdosimetry,radioactive tracers,Tomography(PET)

RecommendedBooks:

1. ConceptsofNuclearPhysics; B.L.Cohen(TMH)
2. IntroductoryNuclearPhysics:KennethS.Krane(Wiley)
3. NuclearandParticlePhysics:Blin-Stoyle(ChapmanandHall)
4. NuclearPhysics; I.Kaplan(Narosa2002)
5. IntroductoryNuclearPhysics:W.Wong
6. IntroductoryNuclearPhysics:S.B.Patel
7. NuclearPhysics:Tayal DC
8. JohnLilley,NuclearPhysics:PrinciplesandApplications,Wiley(2001)

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CorePaper–II(Commonfor all Specializations)

CourseCode	CourseTitle	L	T	P	C
P-402T	**SPECTROSCOPY**	**3**	**0**	**0**	**3**

CourseObjectives:Thiscourseenablesthestudents:

COB1	Understandtheconcept of atomicandmolecularspectra.
COB2	Studythespin-orbit interaction.
COB3	UnderstandRamanandIR spectra.
COB4	Understandconceptofnuclearspinand magneticmoment.
COB5	Understand ESRinstrumentationandapplications.

CourseOutcomes:Afterthecompletionofthiscoursethestudent willbeableto:

COC1	Determinethespectroscopictermsforequivalentandnon-equivalentelectronatom.
COC2	Analyzethe hyperfinesplittingofspectral lines.
COC3	Understandthenuclearspinandmagneticmoment,origin ofnuclearmagneticresonance.
COC4	EvaluatethevibrationalandrotationalRamanspectra.
COC5	Developskillsin estimatingthe hyperfinestructureofESRabsorptions.

Unit I

Atomic Spectra: Different series in alkali spectra (main features), Ritz combination principle, L-Sand j-j coupling; Spectroscopic terms for equivalent and non-equivalent electron atom- Energy leveldiagrams- Spin-Orbit interaction, doublet structure in alkali spectra, selection rules, intensity rules,alkali-likespectra,Lambshift,isotopeshift; hyperfinesplittingofspectrallines,Landeintervalrule.

Unit II

Molecular Spectra: Types of Molecular spectra, Salient features of rotational spectra, rotationalspectra of diatomic molecule as a rigid rotator and a non-rigid rotator, effect of isotopic substitution onrotational spectra, salient features of Vibrational-Rotational spectra, vibrating diatomic molecule as aharmonicoscillator andasanharmonicoscillator.

Raman and Infrared (IR) Spectra: Raman effect, classical and quantum theory of Raman effect,normal vibrations of CO_2 and H_2O molecules, vibrational and rotational Raman spectra. Basic conceptofIRspectroscopy–IRspectrophotometer–PrincipleandInstrumentation,FTIRprincipleandworking.

UnitIII:

NuclearMagneticResonance(NMR)andElectronSpinResonance(ESR)Spectroscopy: Nuclear spin and magnetic moment, origin of nuclear magnetic resonance (NMR) spectra, Theory ofNMRspectra,relaxation process–Blochequations–chemicalshift, experimentalstudy ofNMRspectroscopy, Experimental technique, ESR spectroscopy, origin and resonance condition, hyperfinestructureofESRabsorptions,finestructureinESRspectra,ESRinstrumentation,Applicationsof

ESR.

BooksRecommended

1. ElementsofSpectroscopy -Gupta,Kumar, Sharma
2. AtomicSpectra&AtomicStructure -GerhardHertzberg
3. IntroductiontoMolecularSpectroscopy - G.M.Barrow
4. MolecularSpectroscopy - J.D.Graybeal
5. AtomicandMolecularSpectroscopy -RajKumar
6. MolecularStructure&Spectroscopy - G.Aruldhas
7. IntroductiontoAtomicSpectra - H.E.white
8. FundamentalsofMolecularSpectroscopy -C.N. BanwellandEMMcCash
9. SpectraofDiatomicMolecules - Herzberg
10. SpectroscopyVol.I, II, III - WalkerandStraughen
11. PrinciplesofMagneticResonance - C.P.Slitcher
12. ElectronSpinResonance:TheirApplications - Wertzand Bolton

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Syllabus(Forthe batchadmittedfrom2023-

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ElectivePaper–III

CourseCode	CourseTitle	L	T	P	C
P-403T/SSP	**OPTICALPHENOMENAINSOLIDS**	**3**	**0**	**0**	**3**

CourseObjectives:Thiscourseenablesthestudents:

COB1	Understandtheconcept ofoptical propertiesofsolids.
COB2	Studythedirect andindirect bandgapsemiconductors.
COB3	Understandabsorptionandemissionprocessesofluminescence.
COB4	Understandconceptofquantumefficiency&frequencyresponseofphotodiodes.
COB5	Understandsemiconductormaterialsforfabricationofhomo junctionsolarcells.

CourseOutcomes:Afterthecompletionofthiscoursethestudent will beableto:

COC1	Determinethephoton-phonontransitionsandinter bandtransitions.
COC2	Analyzethe radiativeandnonradiativeprocessesanddecaymechanisms.
COC3	Understandthedifferent kindsofcolorcentersinthecontext ofluminescenceinalkali halides.
COC4	Evaluatedifferent kinds ofluminescence.
COC5	DevelopskillsinestimatingtheFill factor,conversionefficiency,quantumefficiencyofsolar cells.

UnitI:OpticalPropertiesofSolids:
Relationbetweendielectricandopticalproperties(macroscopictheory),Kramer-Kronigrelations,Absorption of electromagnetic radiation, Photon-Phonon transitions, Inter band transitions, Direct andindirect band gap semiconductors -Si and Ge; Absorption coefficients- Infrared absorptions in semi-conductors. Frenkel and Wannier excitons and their absorption, Imperfections - exciton absorption belowthe band gap, Intra-band transitions - Absorption and reflection in metals, Hagen-Rubens relation, Raman,Brillouinand Rayleighscattering, Magneto-optic effects: Faradayeffect.

UnitII:Luminescence:
General considerations of luminescence, exciton, absorption and emission processes of luminescence,Configuration coordinate diagram, Energy level diagram, radiative and non radiative processes, Decaymechanisms, Effect of doping and efficiency, Energy transfer and charge transfer, Different kinds ofluminescence,Electroluminescence-TheGudden-Pohleffect,Destraiueffect,Carrierinjectionluminiscence,PhotoluminescenceandThermo-luminescence,Defectsandcolorcenters,Differentkindsof color centers in the context of luminescence in alkali halides, Thallium activated alkali halides, Zincsulphidephosphors.

UnitIII:Photo-detectorsandPhoto-voltaics:
Photoconductors-dc and ac photo conductors, gain & band width, noise in photo conductors, junctionphotodiodes,PINdiodes,quantumefficiency&frequencyresponse–heterojunctionphotodiodes,

avalanche photo diodes, noise performance of avalanche photo diodes– comparison of avalanche andPINdiodes.

Photovoltaic effect, Types of interfaces, homo junction, hetero junction and Schottky barrier- Choice ofsemiconductor materials for fabrication of homo junction solar cells, equivalent circuit of a solar cell,Solar cell output parameters – Fill factor, conversion efficiency, quantum efficiency, effect of series andshuntresistance onthe efficiencyofsolarcells.

References:

1. Solarcells –CharlesE.Backus,IEEEPress.
2. FundamentalsofSolarcells,Farenbruchand Bube.
3. Principlesoftheoryofsolids –Ziman,VikasPublishingHouse,NewDelhi.
4. SolidState Physics– G.Burns
5. LuminescenceandLuminescentMaterials–Blasse
6. SolidStatePhysics–Dekker.
7. Optoelectronicdevices_P.Bhattacharya
8. Physicsofsemiconductordevices–S.M.Sze.
9. Elementarysolidstatephysics–M.AliOmar

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P403T/MS

ElectivePaper–III

CourseCode	CourseTitle	L	T	P	C
P-403T/MS	**MATERIALSSCIENCE**	**3**	**0**	**0**	**3**

CourseObjectives:Thiscourseenablesthestudents:

COB1	Understandtheconceptofferroicmaterials.
COB2	Studytheclassification ofpolymers.
COB3	Understandmolecularstructureofpolymers.
COB4	Understandconceptofcomposite materials.
COB5	Understandapplicationsofhybridcomposites.

CourseOutcomes:Afterthecompletionofthiscoursethestudent willbeableto:

COC1	Explainthestructuralclassificationofferroelectrics.
COC2	Comparethedomainstructuresinferroelectricmaterials.
COC3	Evaluatethe mechanicalbehavior of polymers.
COC4	Explaincrystallization,meltingandglasstransitionphenomenoninpolymers
COC5	Appreciatetheapplicationsof Ceramicstructuresandglassceramics.

UnitI

FerroicMaterials

Introductiontoferroics,Structuralclassificationofferroelectrics,hydrogen-bondedandnon-hydrogenbondedferroelectrics,Thermodynamicsofferroelectricphasetransitions-proper,improperandpseudo-properferroelectricphasetransitions,Ferroelectricdiffusetransitions,Relaxor ferroelectrics, Domain structures in ferroelectric materials, Orientation of walls betweendomainpairs,Domainwallthickness,Domainswitching,Hysteresisloop,Polycrystallineferroelectrics,sizeeffectsinferroelectricpowders,Applicationsofferroic materials.

Unit II
Polymers&Composites

Polymers: Classificationofpolymers,polymermolecules,chemistryofpolymermolecules,molecularweight, molecular structure of polymers,thermoplastic and thermosetting polymers,polymercrystallanity,mechanicalbehaviorofpolymers-stressstrainbehavior,viscoelasticdeformation,strengthening ofpolymers,crystallization,melting and glass transition phenomenoninpolymers,polymerization, manufacturingofpolymers, applicationsof polymers.

Composites:

Basic Concepts, Definition of Composite materials, reinforcements, Classification of composites-Particle reinforced, Fiber reinforced and structural composites, Particlereinforcedcomposites-large particle composites, dispersion strengthened composites, Carbon-Carbon Composites, HybridComposites,Applications of composites.

UnitIII

Ceramics&Glasses

Ceramics:Introductiontoceramics,classificationofceramics,Ceramicstructures-oxidestructures, silicate structures, Ceramic Phase diagrams- examples of two oxide systems, Differentkinds of Ceramics- glass ceramics, refractories, Properties of Ceramics-Stress-Strain behavior,applicationsofceramics

Glasses – types of glasses, glass ceramics, structure of glasses, properties of glasses, synthesis ofglassesand applications ofglasses.

BooksRecommended:

1. SolidStatePhysics–A.J.Dekker,MacmillanIndiaLtd.,2003.
2. IntroductiontoFerriocMaterials–V.K.Wadhawan,
3. Materials Scienceand EngineeringanIntroduction-W.D. CallisterJr,John Wileyand sons.
4. IntroductiontoCeramics--W.D.Kingery,H.K.BowenandD.R.Uhlmann,JohnWileyandSons.
5. Luminescentmaterials–G.BlasseandC.Grabmaier,Springer-Verlog,1994.

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ElectivePaper-III

CourseCode	CourseTitle	L	T	P	C
P-403T/EI	**INTRUMENTATION FOR MEASUREMENT ANDDATATRANSMISSION**	**3**	**0**	**0**	**3**

CourseObjectives:Thiscourseenablesthestudents:

COB1	Understandtheclassificationoftransducers.
COB2	Studythedisplacement,strainandpressuremeasurement.
COB3	Understandtemperaturesensors.
COB4	Understandconceptof flowmeasurement.
COB5	Understandthemethods ofdatatransmission.

CourseOutcomes:Afterthecompletionofthiscoursethestudent willbeableto:

COC1	Explainthefunctionalityofvarioustransducers.
COC2	Comparethe varioustemperaturemeasuringdevices.
COC3	Evaluatetheultrasonicflowmeter.
COC4	Explaininterfacingtransducerstoelectroniccontrolandmeasuringsystems
COC5	Appreciatethe multiplexingintelemeteringsystem.

Unit I

Transducers: Classification of transducers – Active and Passive transducers- Electrical transducers- Displacement transducers -Digital transducers -Basic requirement of a transducer,**DisplacementMeasurement:** Variable resistance devices– Variable inductance devices -Variable capacitancedevices.

Strain Measurement: Theory of operation of strain gauge –Types of strain gauges –Strain gaugecircuits -Fullbridge.

Pressure Measurement: Bourdon Tube- Bellows - Potentiometer device- Strain gauge transducer –LVDT type transducer.

Unit II

Temperature Measurement: Classification of temperature measuring devices-Resistance typetemperature sensors (platinum resistance thermometer, thermistors) –Resistance thermometer circuits-Thermocouples-Temperature Control-Liquid levelcontrol.

FlowMeasurement:Classificationofflowmeters–Headtypeflowmeters-–Ultrasonicflowmeter-DCand ACServomotors-Stepper motor.

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Unit III

DataTransmissionandTelemetry:

Analog and Digital Data Acquisition Systems: Interfacing transducers to electronic control andmeasuringsystems– IEEE488 Bus.

Methodsofdatatransmission–Generaltelemetrysystem-Functionalblocksoftelemetrysystem–

Types of telemetry systems–Land line telemetering system-Voltage telemetering systems–Currenttelemetering system-Position telemetering system– Land line telemetry–Multiplexing in telemeteringsystem.

RecommendedBooks:

1. ModernElectronicInstrumentationandMeasurementTechniques– A.O.HelfrickandW.D.Cooper,Prentice HallIndia Publications.
2. InstrumentationDevicesandSystems- C.S.Rangan,G.R.SharmaandVSVMani,TataMc.GrawHillPublications.
3. IntroductiontoinstrumentationandControl-A.K.Ghosh–PrenticeHallIndiaPublications.
4. ElectricalandElectronicsMeasurementandInstrumentation–A.K.Sawhney.
5. TransducersandInstrumentation –DVSMurthy,PHIPublications.

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ElectivePaper –III

CourseCode	CourseTitle	L	T	P	C
P-403T/NS	**NANOCOMPOSITES**	**3**	**0**	**0**	**3**

CourseObjectives:Thiscourseenablesthestudents:

COB1	Understandtheconceptofnuclearforces.
COB2	Studythenuclearmodelsanditsmagneticmoments.
COB3	Understandnucleardecayand nucleardetection.
COB4	Understandconceptofinteractionofchargedparticleswithmatter.
COB5	Understandapplications ofnuclearphysics.

CourseOutcomes:Afterthecompletionofthiscoursethestudent willbeableto:

COC1	Explainthefunctionalityofvarioustransducers.
COC2	Comparethevarioustemperaturemeasuringdevices.
COC3	Evaluatetheultrasonicflowmeter.
COC4	Explaininterfacingtransducerstoelectroniccontrolandmeasuringsystems
COC5	Appreciatethemultiplexingintelemeteringsystem.

Unit-I: Introduction: Nanocomposites, nanofillers, classification of nanofillers, carbon and non-carbon basednanofillers-synthesis and properties of fillers, Nano composites containing functionalized nanoparticles : organicandpolymermaterialsforlight–emittingdiodes,

Polymernanocomposites: Nanotube/polymercomposites,layeredfillerpolymercompositeprocessing–polyamide matrices, polyimide matrices, polypropylene and polyethylene, matrices, liquid–crystal matrices,Epoxy and polyurethane matrices and rubber matrices, photo-oxidation of light emitting polymers, nanoparticlesapproachestoenhancethelifetime ofemittingpolymers. (15)

Unit-II:SynthesisofNanocomposites: Direct Mixing ,Solution Mixing,In–SituPolymerization,In-SituParticle processing ceramic / polymer composites, In-Situ particle processing, metal / polymer nanocomposites,modification of interfaces, modification of nanotubes, modification of nanoparticles, wear resisting polymernanocomposites: preparation and properties, surface treatment, composites manufacturing, wear performance andmechanism.(15)

Unit-III:MechanicalPropertiesofNanocomposites:modulusandtheLoad–Carrying,capabilityofnanofillers,failurestressandstrainToughness,glassTransitionandRelaxationBehavior,abrasionandwear resistance , permeability , dimensional stability constants, thermal stability and flammability, electrical and opticalproperties,resistivity,permittivity,andbreakdownstrength,refractiveindex,lightemittingdevices.(15)

ReferenceBooks:

1. EncyclopediaofNanotechnology–Hari SinghNalwa
2. Springer Handbookof Nanotechnology–BharatBhushan
3. HandbookofSemiconductorNanostructuresandNanodevices,Vol1-5-ABalndin,K.LWang.
4. NanostructuresandNanomaterials-Synthesis,PropertiesandApplications –Cao,Guozho

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ElectivePaper–III

CourseCode	CourseTitle	L	T	P	C
P-403T/EC	**MOBILECELLULARCOMMUNICATIONS**	**3**	**0**	**0**	**3**

CourseObjectives:Thiscourseenablesthestudents:

COB1	Tounderstandtheconceptofmobilecommunication.
COB2	Todescribethespreadspectrumsystems.
COB3	Toexaminemediumaccesscontrol.
COB4	Todescribediversitybranchandsignalpaths.
COB5	Tounderstandtheuseofsatellitesinmobilecommunications.

CourseOutcomes:Afterthecompletionofthiscoursethestudent willbeableto:

COC1	Explainthefundamentalradiopropagation andsystemconcepts.
COC2	Compare thevarious mediumaccessingmethods.
COC3	Evaluatethetransmissioncharacteristics of GSM.
COC4	DifferentiateGEO,LEO,MEO,routingandlocalization.
COC5	Appreciatethe digitalvideobroadcasting.

Unit I

CellularConcepts:Mobilecommunications-evolution,Standards,SpeechCoder.
Fundamental Radio Propagation and System concepts, Antenna Gain, Propagation characteristics,model for multipath-faded radiosignals.
SpreadSpectrumSystemsandDiversityTechniques:ConceptofSpreadSpectrumSystem,pseudo-noise sequences, performance of Direct Sequence Spread Spectrum Systems, Code DivisionMultiple Access, Direct Sequence and Frequency Hopping systems and synchronization. Concept ofDiversityBranchandSignalPaths,CombiningandSwitchingMethods,Carrier-to-NoiseandCarrier-to-Interference Ratio, Performance Improvements.

UnitII

Medium Access Control: Motivation for a specialized MAC, Hidden and exposed terminals, Nearand far terminals, SDMA, FDMA, TDMA, Fixed TDM, Classical Aloha, Slotted Aloha, Carrier sensemultipleaccess,Demandassignedmultipleaccess,PRMApackerreservationmultipleaccess,Reservation TDMA, Multiple access with collision avoidance, Polling, Inhibit sense multiple access,CDMA,Spread Aloha multiple access, ComparisonofS/T/F CDMA.

Telecommunication Systems: GSM, Mobile services, System architecture, Radio interface, Protocols,Localizationand calling, Handover,Security, New data services.

Unit III

SatelliteSystems:History,Applications,Basics,GEO,LEO,MEO,Routing,Localization,Handover, Examples.

Satelliteapplications:Communicationsatellites,surveillancesatellite,navigationsatellites.Globalpositioningsystem(GPS)spacesegment, controlsegment, GPSreceivers, GPSapplications.

BroadcastSystems:Overview,cyclicrepetitionofdata,Digitalaudiobroadcasting,Multimediaobjecttransferprotocol, Digitalvideobroadcasting,

RecommendedBooks:

1.Wireless Digital Communications --Kamilo Feher2.MobileCommunicationsJochen Schiller
3.Compositesatelliteandcabletelevision.R.RGulati(NewAge International Pub)4.MobileCellularTelecommunicationsW.C.Y. Lee[Second Edition]

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ElectivePaper–III

CourseCode	CourseTitle	L	T	P	C
P-403T/BP	**CELLANDMEMBRANEBIOPHYSICS**	**3**	**0**	**0**	**3**

CourseObjectives:Thiscourseenablesthestudents:

COB1	Tounderstandtheconceptofmobilecommunication.
COB2	Todescribethespreadspectrumsystems.
COB3	Toexaminemediumaccesscontrol.
COB4	Todescribediversitybranchandsignalpaths.
COB5	Tounderstandtheuseofsatellitesinmobilecommunications.

CourseOutcomes:Afterthecompletionofthiscoursethestudent willbeableto:

COC1	Explainthefundamental radio propagationand systemconcepts.
COC2	Comparethe various mediumaccessingmethods.
COC3	EvaluatethetransmissioncharacteristicsofGSM.
COC4	DifferentiateGEO,LEO,MEO,routingandlocalization.
COC5	Appreciatethedigitalvideobroadcasting.

UnitI:CellularOscillationsandPhysicsofchargedmembrane

Cellular Oscillations: Cell, structure of cell, cell division, Electrical oscillatory phenomenon associatedwith cellular reproductive cycle. Electrical oscillations related to the contact inhibition of reproduction incells.
Originofcellularspinresonance–Abipolarrotationalconduction.Asymmetriccelltocellpolarization.Cellular spin resonance (CSR). Evidences of oscillating electric fields from cells by CSR.**ChargedCellMembrane**:Excitabletissues-nerveandmusclecells,actionpotential,Membranemodels, membrane channels, membrane capacitance, relation among capacitance, resistance and diffusionbetweentwoconductors.Fick’sfirstlawandsecondlawofdiffusion.Movementofsubstanceacrossmembrane:Donnanequilibrium.Potentialchangeattheequilibrium.Ionmovementinsolution:theNernst –Planckequation.Zerototalcurrent inaconstantfieldmembrane–Goldmann equation.

UnitII:BiologicalcellDielectrophoresisandMagnetophoresis
Dielectrophoresis Behaviour of charged and neutral matter in (a) uniform and (b) non-uniform electricfields. Types of polarization.Field geometries – spherical, cylindrical and isomotive. Dielectrophoreticforceinradialfield.Dielectrophoreticcollectionrate(DCR)ofcellsinradialfield.Experimental techniqueforDCRofbiologicalcells.Calculationofexcesspermittivityofcells.Singlecelldielectrophoresis -Experimental technique for the determination retention voltage and calculation ofexcesspermittivityof lonecells.
Magnetophoresis : Introduction to Magnetophoresis. Behaviour of charge and neutral matter in magneticfield.Theoryandexperimentaltechniqueofmagnetophoresis.Biologicalapplicationsofmagnetophoresis.

UnitIII:Physicsofnaturalflyingmachine

Flightsurface(wing);Flightmuscles;Sensoryorgans;LaminarandTurbulantflow,equationofcontinuity, bernoulli's equation, reynold's number. Basics/Fundamentals of aerodynamics. Wind tunnel–types. Physics of wing beat– Mechanical oscillator theory; Theory based on Newton's laws; Theorybased on Dimensional analysis; Mass flow theory. Types of flight – Hovering; forward horizontal flight;gliding flight; Soaring flight. Aerodynamic forces – lift, thrust and drag. Components of power, Powerrequirementsofflight. ApplicationsofnaturalflighttoMicroVehicles.

RecommendedBooks:

1. Dielectrophoresis–Pohl.
2. Electromechanicsofparticles–ThomasB.Jones.
3. IntermediatePhysicsforMedicineandbiology–RusselK,Hobby.
4. Bio-physicsofBirdFlight–N.Chari.
5. BioAerodynamicsofavianflight–N.Chari.
6. Fundamentalsof Aerodynamics–JohnD.Anderson,Jr.

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P403T/CMP

ElectivePaper - III

CourseCode	CourseTitle	L	T	P	C
P-403T/CMP	**TRANSPORTPHENOMENAINSOLIDS**	**3**	**0**	**0**	**3**

CourseObjectives:Thiscourseenablesthestudents:

COB1	Tounderstandtheconceptofmobilecommunication.
COB2	Todescribethespreadspectrumsystems.
COB3	Toexaminemediumaccesscontrol.
COB4	Todescribediversitybranchandsignalpaths.
COB5	Tounderstandtheuseofsatellitesinmobilecommunications.

CourseOutcomes:Afterthecompletionofthiscoursethestudent willbeableto:

COC1	Explainthefundamental radio propagationand systemconcepts.
COC2	Compare the various mediumaccessingmethods.
COC3	EvaluatethetransmissioncharacteristicsofGSM.
COC4	DifferentiateGEO,LEO,MEO,routingandlocalization.
COC5	Appreciatethedigitalvideobroadcasting.

UNIT-I

Diffusioninsolids-Ficksfirstlawandsecondlaw,Diffusioncoefficientthroughplanesurface,cylinderandsphere, Application based on secondlawof diffusion.
Diffusioninasimplecubicstructure,Diffusionunderexternalfield,Nernst-Einsteinrelation,Kirkendallshift.
Ionicconductivity,Ionicconductivityofalkalihalidesandeffectofdivalentimpuritiesonionicconductivity.
ThermodynamicsofSpecificHeats:TheSpecificheat ofalinearcrystal,Debyetheoryapplied toalinearcrystal andthree dimensionalcrystal.
Temperaturedependenceoftheamplitudeofvibrationssolids:TheLindemannLawofMelting.Thermoelectrice ffects,Thermopower, Seebeckeffect,Peltier effect,The Wiedemann-Franzlaw.

UNIT-II

ElectronTransportPhenomenon:Motionofelectronsinbandsandtheeffectivemasstensor(semi-classicaltreatment), Currents in bands and holes.
Hoppingconduction,Electricalconductivityofmetals-Polorons-smallpoloronbandconduction;largepoloronband conduction;smallpoloron hoppingconduction; Motttransitions;IonicConductivity;SuperionicConductivity-structure,defectsandconductivity.Theelectricalconductivityatlowtemperatures, Matheissen’srule.

UNIT-III

Electronicstructureof1Dsystems:1Dsub-bands,VanHovesingularities;1Dmetals-Coulombinteractionsandlatticecouplings.

Electrical transport in 1D: Conductance quantization and the Landau formula, two barriers in seriesresonanttunnelling.IncoherentadditionandOhm's law, Coherence-Localization.

Electronic structure of 0D systems (Quantum dots): Quantized energy levels, Semiconductor and metallicdots, Optical spectra, discrete charge states and charging energy. Electrical transport in 0D-Coulombblockadephenomenon.

MagnetoresistanceandtheHalleffect.Magnetoresistanceintwobandmodel.

Recommendedbooks

1. PrinciplesofTheorySolids:Ziman
2. SolidStatePhysics: Singhal
3. SolidStatePhysics: H.C.Gupta
4. ElementarySolidStatePhysics:M.Ali Omar
5. Solid State Physics:M.A.Waheb
6. SolidStatePhysics:Kachchava,
7. PrinciplesoftheSolid StatePhysics:H.V.Keer
8. IntroductiontoSolidState Physics(7th edition): CKittel
9. SolidStatePhysics:W.Ashcroftand N.DavidMermin
10. SolidStatePhysics:A.K.Saxena

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ElectivePaper-III

CourseCode	CourseTitle	L	T	P	C
P-403T/OE	**FIBEROPTICTECHNOLOGY**	**3**	**0**	**0**	**3**

CourseObjectives:Thiscourseenablesthestudents:

COB1	Tounderstandthelight propagationthroughanopticalwaveguide.
COB2	Todescribetheformationofmodesinplanarandcylindricalwaveguides.
COB3	Toexaminethetransmissioncharacteristicsofopticalfibers.
COB4	Todescribedifferentnonlineareffectsinopticalfibers.
COB5	Toidentifytheapplicationsof opticalfiber.

CourseOutcomes:Afterthecompletionofthiscoursethestudent willbeableto:

COC1	Explainthepropagationoflightthroughanoptical waveguide.
COC2	Comparetheformationofmodesinplanarandcylindrical waveguides.
COC3	Evaluatethetransmissioncharacteristicsofopticalfibers.
COC4	Differentiatenonlineareffectsinopticalfibers.
COC5	Appreciatetheapplicationsofopticalfiber.

Unit I: Optical fiber Guide: Ray theory transmission: total internal reflection, numerical aperture, planarwave guides, guided and radiation modes, TE and TM modes in a symmetric step-index planar waveguide, Nonplanar waveguides, types of fibers – multimode and single mode; step and graded index, skewrays,modesinopticalfibers,modalanalysisforastep-indexandparabolicindexfibers,cut-offwavelength.

Unit II: Transmission Characteristics of Optical Fibers: Attenuation - material absorption losses,linearandnonlinearscatteringlosses,Dispersion-intermodaldispersioninstepandgradedindexmultimodefibers,intramodaldispersion,dispersionmodifiedsingle-modefiber,fiberbirefringence,polarization-modedispersion.

Nonlineareffectsofopticalfibers: Nonlinearrefraction,groupvelocitydispersion,crossphasemodulation, self-phase modulation, Four wave mixing, stimulated Raman scattering, stimulated Brillouinscattering,fiber solitons.

Unit III: Optical Fiber communication Systems: Elements of fiber optic system, analog and digitalsignals, analog systems – signal-to-noise ratio, digital systems - power budgeting, bit error ratio, opticaltransmittercircuit-sourcelimitations,drivecircuitsforLEDand LASER; optical receivercircuit.

Multiplexingsystems: Opticaltimedivisionmultiplexing,wavelengthdivisionmultiplexing.

Optical Networks: Network topologies, local area networks – SONET/SDH, FDDI, WDM light wavenetworks –single-hop andmulti-hopoperations, ultrahigh capacitynetworks.

ReferenceBooks:

1. Optical Fiber communications: principles and practice - John M.Senior, Pearson Education,3rdedition.
2. OpticalFibercommunications-GerdKeiser,McGraw-Hill,4thedition.
3. FiberOpticscommunications -GovindP.Agarwal,AcademicPress,3rdedition.
4. IntroductiontoFiberOptics-A.GhatakandK.Thyagarajan,CambridgeUniversityPress
5. FiberOpticCommunications-JosephC.Palais,Pearson,5thEdition.
6. WDMoptical Networks-C. SivaRamMurthyandMohan Guruswamy,PrenticeHall,2002.

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CorePaper -I

CourseCode	CourseTitle	L	T	P	C
P-401T/AE	**DIGITALSYSTEMDESIGNUSINGVHDL**	**3**	**0**	**0**	**3**

CourseObjectives:Thiscourseenablesthestudents:

COB1	TounderstandtheimportanceofVHDL .
COB2	Todescribethevariousmodelingtechniquestodesignthedigitalcircuits.
COB3	Toexaminethesimulationandworkingofthedesignedcircuits.
COB4	TodescribehardwaremodelingusingVHDL.
COB5	ToidentifytheapplicationsofVHDL.

CourseOutcomes:Afterthecompletionofthiscoursethestudent willbeableto:

COC1	ExplaintheuseofVHDLindesigninganygivendigital circuit.
COC2	Comparethe different stylesof modelingusingVHDL.
COC3	Evaluatethefunctionalityand theversatilityofVHDL.
COC4	Differentiatesimulationandimplementationofthedesignofdigitalcircuits.
COC5	AppreciatetheapplicationsofVHDL.

Unit-I:Basic*LanguageElements***:** Identifiers,Dataobjects,Datatypes,Operators.

Behavioral Modeling **:** Entity declaration, Architecture body, Process statement, Variable assignmentstatement,Signalassignmentstatement,Waitstatement,Ifstatement,Casestatement,Loopstatement,Exit statement,Next statement, Assertionstatement, Report statement.

Data Flow Modeling: Concurrent signal assignment statement, Concurrent versus sequential signalassignment, Delta delay revisited, Multiple drivers, Conditional signal assignment statement, selectedsignal assignment statement. The unaffected value, block statement, concurrent assertion statement,Value of asignal

Structural Modeling: An Example, Component declaration, Component instantiation and examples,Resolving signal values. Generics**,** Configuration specification, Configuration declaration, Defaultrules,Conversionfunctions, Directinstantiation, Incrementalbinding.

Unit-II:*SubprogramsandOverloading:*Subprograms-Subprogramoverloading,Operatoroverloading,Signatures, Defaultvalues forparameters.

*PackagesandLibraries:*Packagedeclaration,Packagebody,Designfile,Orderofanalysis,implicitvisibility,explicitvisibility.

*AdvancedFeatures:*Entitystatements,Generatestatement,Aliases,Qualifiedexpressions,Typeconversions,Guarded signals,Attributes,Aggregate targets,more details onports.

Unit-III:*ModelSimulation:*Simulation-WritingaTestBench-Convertingrealandintegertotime-Dumpingresultsintoatextfile-Readingvectorsfromatextfile-Atestbenchexample-Initializinga memory-Variablefile names.

*HardwareModelingExamples:*Modelingentityinterfaces,modelingsimpleelements,Different styles of modeling, modeling regular structures, modeling delays, modeling conditional operations,modeling synchronous logic. State machine modeling, Interacting state machines, modeling a MooreFSM, modelinga MeaslyFSM.

RecommendedBooks:

1. AVHDLPrimer-ByJ.Bhasker.,PearsonEducation Asia,11^{th} IndianReprint,2004.
2. VHDLProgrammingbyExample-ByDouglasL. Perry,4^{th}Ed.,TMH., 2002.
3. IntroductoryVHDL:FromSimulationtoSynthesis-BySudhalarYalamanchili.,PearsonEducation Asia2001..
4. FundamentalsofDigitalLogicwithVHDLDesign-ByStephenBrown&ZvonkoVranesic.,THM2002.
5. DigitalSystemsDesignusingVHDLbyCharlesH.RothJr.PWSPub.,1998.
6. VHDL–Analysis&ModelingofDigitalSystems-ByZainalabedinNavabi.,2^{nd} Ed., MH., 1998.

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M.Sc. (Physics) - Semester-IV
Syllabus(Forthe batchadmittedfrom2023-2024onwards)

CorePaper-II

CourseCode	CourseTitle	L	T	P	C
P-402T/AE	**FEEDBACKCONTROLSYSTEMS**	**3**	**0**	**0**	**3**

CourseObjectives:Thiscourseenablesthestudents:

COB1	Tounderstandthefeedbackon theresponse ofcontrolsystems.
COB2	Todescribethetransferfunctionofthegivensystems.
COB3	Toexaminethe timedomainanalysisofcontrolsystems.
COB4	Todescribetheconcept ofstabilityofthecontrol system.
COB5	Toidentifytheapplicationsoffeedbackincontrolsystems.

CourseOutcomes:Afterthecompletionofthiscoursethestudent willbeableto:

COC1	Explaintheuseofsignal flowgraphstodescribethefunctionalityofthegivensystem.
COC2	Toevaluatethetimeresponse ofcontrol systems–steadystateerror.
COC3	Evaluatethefeedbackcompensation techniques.
COC4	TodescribetimedomaininterpretationanddesignofPIcontroller–designwithPIDcontroller anddesign withphaseleadcontroller.
COC5	AppreciatetheapplicationsofFeedbackcontrol mechanismincontrol systems.

Unit–I:GeneralconceptsandMathematical techniques:
Introduction, Openloopcontrolsystem, Closedloopcontrolsystems,Modern controlsystemapplications .Transfer function concept, transfer function of common networks (RC, RL & RLC), Transfer function ofphysical systems, Block Diagram Representation of Control System, Block Diagram reductions, SignalFlow Graph and Masons Gain formula, Reduction of signal flow Graphs, Applications of signal flowGraph .

StateequationsandTransferFunctionrepresentationofPhysicalcontrol system elements:
State Space Concepts, the State Variable Diagram. State Equations of Electrical Networks, TransferFunctionAndStateSpaceRepresentationOfTypicalMechanical,Electrical,Hydraulic,ThermalSystems.

Unit – II:

Time domain analysis of control systems: Typical Test Signals for the Time Response of ControlSystems – Steady State Error – Unity Feedback Systems. Steady State Error For A Unity FeedbackSystem With Step Input, Ramp Input And Parabolic Input – Unit Step Response And Time DomainSpecifications – Transient Response of aPrototype Second Order System – Effect Of Adding Poles AndZerosTo TransferFunctions.**The ConceptofStability**–Routh-HurwitzStability Criterion-TheStabilityofStateVariableSystems–RootLocusmethod,RootLocusConcept–PropertiesandConstructionofRootLoci–FrequencyPlots–PolarandBodeplots–FrequencyDomainSpecifications

–resonantpeak,resonantangularfrequencyandbandwidthof2^{nd}OrderSystem-NyquistStabilityCriterion–Applications.

Unit – III : Design of Control Systems – Introduction, Cascade Compensation Techniques, Minor loopfeedback compensation techniques, and example of the design of a linear feedback control system–Design with PD controller – Time Domain interpretation of PD controller – Design with PI controller – Time domain interpretation and design of PI controller – Design with PID controller – Design with phaselead controller – Time domain interpretation and design of phase lead controller – Design with phase lagcontroller – Time domain interpretation and design of phase lag controller – Design with lead and lagcontroller – Polo zerocancellation compensation.

RecommendedBooks

1. AutomaticControl systems –BenjaminC.Kuo,(PHI)
2. ModernControl systems–RichardC.DorfandRobertH.Bishop,Addison WesleyPublications
3. Control systemsprinciplesanddesign-byM.Gopal2^{nd} edition2002(MGH)
4. Control andSystems Engineering–IJNagarathandM Gopal,(New AgeIntPub)
5. Moderncontrolengineering–KatsuhikoOgata–PHI.

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ElectivePaper–III

CourseCode	CourseTitle	L	T	P	C
P-403T/AE	**GUIDEDANDUNGUIDEDMEDIACOMMUNICATION**	**3**	**0**	**0**	**3**

CourseObjectives:Thiscourseenablesthestudents:

COB1	Tounderstandtheguidedandunguidedmediacommunicationmechanism.
COB2	Todescribetheopticalfiberandmicrowavecommunication.
COB3	Toexaminethetechniquesinvolvedinmobilecellularcommunications.
COB4	Todescribetheconcept ofanaloganddigitalcellularcommunications.
COB5	Toidentifytheapplicationsofcommunicationsin dayto daylife.

CourseOutcomes:Afterthecompletionofthiscoursethestudentwill beableto:

COC1	Explaintheuseofsignal flowoptical fibersystems.
COC2	Toevaluatethetransmissioncharacteristicsinopticalfibers.
COC3	Evaluatethedispersionmechanismsinopticalfibersandcellularcommunications.
COC4	Todescribe waveguidesandcomponentsusedinmicrowavecommunication.
COC5	Appreciatetheapplicationsofguidedandunguidedmediaincommunications.

Unit I
OpticalFibercommunication:
Electromagnetic Mode Theory for Optical Propagation- Electromagnetic Waves, Modes in a planarwave guide, Phase and Group velocity, Phase shift with total internal reflection and Evanescent fields.Cylindrical optical Fiber-Modes, Mode coupling,Step index fiber, Graded index fiber and WKBmethod.

Transmission characteristics- Attenuation, absorption, intrinsic and extrinsic absorption. intra-modal and inter-modaldispersion.

Unit II
Waveguidesandcomponents:
Rectangular Waveguides, Solutions of Wave equations in Rectangular coordinates , TE modes inRectangular Waveguides, TM modes in Rectangular Waveguides, Circular Waveguides, Solutions ofWave equations in Cylindrical coordinates, TE modes in Cylindrical Waveguides, TM modes inCylindrical Waveguides, TEM modes in Cylindrical Waveguides, Microwave cavities, Rectangularcavity resonator,Circularcavity resonator,Semicircularcavity resonator,QFactorofaCavityResonator.

Unit III
CellularMobilecommunication:
A basic cellular system, Performance criteria, Operation of cellular systems, Hexagonal shaped cells,Planningacellularsystem,Elementsofcellularsystemdesign,Frequencyreuse,Co-channelinterferencereductionfactor, Hand-off mechanism,Cellsplitting, ConceptofSpreadSpectrum,Frequency-HoppingSpreadSpectrum,DirectSequenceSpread

Spectrum,CodeDivisionMultipleAccess.

Analog And Digital Cellular Systems: Definitions of terms and functions, Introduction to digitaltechnology, ARQ techniques, Digital speech, Digital mobile telephony, Multiple access schemes,Globalsystemfor mobile (GSM).

TEXTBOOKS:

1. Opticalfibercommunication- John M.Senior.
2. Opticalfibercommunication—GKeiser
3. SemiconductorOptoelectronics—PallabBhattacharya.
4. MicrowaveDevicesand circuits-ByS.Y.Liao
5. FundamentalsofMicrowaveEngineering-R.E.Collin-McGraw-HillInternational
6. MobileCellularTelecommunicationsbyWilliamC.Y.Lee.[McGRAWHILL].

REFERENCEBOOKS:

1. Opticalcommunicationsystem—J.Gower
2. Fundamentalsoffiberoptical communicationandsensorsystem—BishnuPPal.
3. Integratedoptics–Theoryandtechnology—R.Ghunspurger.

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