VISVESVARAYA TECHNOLOGICAL UNIVERSITY
BELAGAVI

Scheme of Teaching and Examination and Syllabus
B.E. (Common to all Programmes)
III SEMESTER
(Effective from Academic year 2018-19)

B. E. Common to all Programmes
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - III

TRANSFORM CALCULUS, FOURIER SERIES AND NUMERICAL TECHNIQUES

Course Code	**18MAT31**	CIE Marks	40
Teaching Hours/Week (L: T:P)	(2:2:0)	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- To have an insight into Fourier series, Fourier transforms, Laplace transforms, Difference equations and Z-transforms.
- To develop the proficiency in variational calculus and solving ODE's arising in engineering applications, using numerical methods.

Module-1

Laplace Transform: Definition and Laplace transforms of elementary functions (statements only). Laplace transforms of Periodic functions (statement only) and unit-step function – problems.
Inverse Laplace Transform: Definition and problems, Convolution theorem to find the inverse Laplace transforms (without Proof) and problems. Solution of linear differential equations using Laplace transforms.

Module-2

Fourier Series: Periodic functions, Dirichlet's condition. Fourier series of periodic functions period 2π and arbitrary period. Half range Fourier series. Practical harmonic analysis.

Module-3

Fourier Transforms: Infinite Fourier transforms, Fourier sine and cosine transforms. Inverse Fourier transforms. Problems.
Difference Equations and Z-Transforms: Difference equations, basic definition, z-transform-definition, Standard z-transforms, Damping and shifting rules, initial value and final value theorems (without proof) and problems, Inverse z-transform and applications to solve difference equations.

Module-4

Numerical Solutions of Ordinary Differential Equations(ODE's):
Numerical solution of ODE's of first order and first degree- Taylor's series method, Modified Euler's method. Runge -Kutta method of fourth order, Milne's and Adam-Bash forth predictor and corrector method (No derivations of formulae)-Problems.

Module-5

Numerical Solution of Second Order ODE's: Runge-Kutta method and Milne's predictor and corrector method. (No derivations of formulae).
Calculus of Variations: Variation of function and functional, variational problems, Euler's equation, Geodesics, hanging chain, problems.

Course outcomes: At the end of the course the student will be able to:

- CO1: Use Laplace transform and inverse Laplace transform in solving differential/ integral equation arising in network analysis, control systems and other fields of engineering.
- CO2: Demonstrate Fourier series to study the behaviour of periodic functions and their applications in system communications, digital signal processing and field theory.
- CO3: Make use of Fourier transform and Z-transform to illustrate discrete/continuous function arising in wave and heat propagation, signals and systems.
- CO4: Solve first and second order ordinary differential equations arising in engineering problems using single step and multistep numerical methods.
- CO5:Determine the externals of functionals using calculus of variations and solve problems arising in dynamics of rigid bodies and vibrational analysis.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.

- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Advanced Engineering Mathematics	E. Kreyszig	John Wiley & Sons	10th Edition, 2016
2	Higher Engineering Mathematics	B. S. Grewal	Khanna Publishers	44th Edition, 2017
3	Engineering Mathematics	Srimanta Pal et al	Oxford University Press	3rd Edition, 2016
Reference Books				
1	Advanced Engineering Mathematics	C. Ray Wylie, Louis C. Barrett	McGraw-Hill Book Co	6th Edition, 1995
2	Introductory Methods of Numerical Analysis	S.S.Sastry	Prentice Hall of India	4th Edition 2010
3	Higher Engineering Mathematics	B.V. Ramana	McGraw-Hill	11th Edition,2010
4	A Textbook of Engineering Mathematics	N.P.Bali and Manish Goyal	Laxmi Publications	6th Edition, 2014
5	Advanced Engineering Mathematics	Chandrika Prasad and Reena Garg	Khanna Publishing,	2018

Web links and Video Lectures:

1. http://nptel.ac.in/courses.php?disciplineID=111
2. http://www.class-central.com/subject/math(MOOCs)
3. http://academicearth.org/
4. VTU EDUSAT PROGRAMME - 20

B. E. Common to all Programmes
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)
SEMESTER - III

ADDITIONAL MATHEMATICS – I
(Mandatory Learning Course: Common to All Programmes)
(A Bridge course for Lateral Entry students under Diploma quota to BE/B. Tech. programmes)

Course Code	**18MATDIP31**	CIE Marks	40
Teaching Hours/Week (L:T:P)	(2:2:0)	SEE Marks	60
Credits	**0**	Exam Hours	03

Course Learning Objectives:

- To provide basic concepts of complex trigonometry, vector algebra, differential and integral calculus.
- To provide an insight into vector differentiation and first order ODE's.

Module-1

Complex Trigonometry: Complex Numbers: Definitions and properties. Modulus and amplitude of a complex number, Argand's diagram, De-Moivre's theorem (without proof).
Vector Algebra: Scalar and vectors. Addition and subtraction and multiplication of vectors- Dot and Cross products, problems.

Module-2

Differential Calculus: Review of successive differentiation-illustrative examples. Maclaurin's series expansions-Illustrative examples. Partial Differentiation: Euler's theorem-problems on first order derivatives only. Total derivatives-differentiation of composite functions. Jacobians of order two-Problems.

Module-3

Vector Differentiation: Differentiation of vector functions. Velocity and acceleration of a particle moving on a space curve. Scalar and vector point functions. Gradient, Divergence, Curl-simple problems. Solenoidal and irrotational vector fields-Problems.

Module-4

Integral Calculus: Review of elementary integral calculus. Reduction formulae for $\sin^n x$, $\cos^n x$ (with proof) and $\sin^m x \cos^n x$ (without proof) and evaluation of these with standard limits-Examples. Double and triple integrals-Simple examples.

Module-5

Ordinary differential equations (ODE's. Introduction-solutions of first order and first-degree differential equations: exact, linear differential equations. Equations reducible to exact and Bernoulli's equation.

Course Outcomes: At the end of the course the student will be able to:

- CO1: Apply concepts of complex numbers and vector algebra to analyze the problems arising in related area.
- CO2: Use derivatives and partial derivatives to calculate rate of change of multivariate functions.
- CO3: Analyze position, velocity and acceleration in two and three dimensions of vector valued functions.
- CO4: Learn techniques of integration including the evaluation of double and triple integrals.
- CO5: Identify and solve first order ordinary differential equations.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Sl No	**Title of the Book**	**Name of the Author/s**	**Name of the**	**Edition and Year**

			Publisher	
Textbook				
1	Higher Engineering Mathematics	B. S. Grewal	Khanna Publishers	43rd Edition, 2015
Reference Books				
1	Advanced Engineering Mathematics	E. Kreyszig	John Wiley & Sons	10th Edition, 2015
2	Engineering Mathematics	N. P .Bali and Manish Goyal	Laxmi Publishers	7th Edition, 2007
3	Engineering Mathematics Vol. I	Rohit Khurana	Cengage Learning	1st Edition, 2015

B. E. Common to all Programmes
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SEMESTER - IV

COMPLEX ANALYSIS, PROBABILITY AND STATISTICAL METHODS

Course Code	**18MAT41**	CIE Marks	40
Teaching Hours/Week (L:T:P)	(2:2:0)	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- To provide an insight into applications of complex variables, conformal mapping and special functions arising in potential theory, quantum mechanics, heat conduction and field theory.
- To develop probability distribution of discrete, continuous random variables and joint probability distribution occurring in digital signal processing, design engineering and microwave engineering.

Module-1

Calculus of complex functions: Review of function of a complex variable, limits, continuity, and differentiability. Analytic functions: Cauchy-Riemann equations in Cartesian and polar forms and consequences.
Construction of analytic functions: Milne-Thomson method-Problems.

Module-2

Conformal transformations: Introduction. Discussion of transformations:$w = Z^2, w = e^z, w = z + \frac{1}{z}, (z \neq 0)$.Bilinear transformations- Problems.
Complex integration: Line integral of a complex function-Cauchy's theorem and Cauchy's integral formula and problems.

Module-3

Probability Distributions: Review of basic probability theory. Random variables (discrete and continuous), probability mass/density functions. Binomial, Poisson, exponential and normal distributions- problems (No derivation for mean and standard deviation)-Illustrative examples.

Module-4

Statistical Methods: Correlation and regression-Karl Pearson's coefficient of correlation and rank correlation -problems. Regression analysis- lines of regression –problems.
Curve Fitting: Curve fitting by the method of least squares- fitting the curves of the form-
$y = ax + b, y = ax^b and y = ax^2 + bx + c.$

Module-5

Joint probability distribution: Joint Probability distribution for two discrete random variables, expectation and covariance.
Sampling Theory: Introduction to sampling distributions, standard error, Type-I and Type-II errors. Test of hypothesis for means, student's t-distribution, Chi-square distribution as a test of goodness of fit.

Course Outcomes: At the end of the course the student will be able to:

- Use the concepts of analytic function and complex potentials to solve the problems arising in electromagnetic field theory.
- Utilize conformal transformation and complex integral arising in aerofoil theory, fluid flow visualization and image processing.
- Apply discrete and continuous probability distributions in analyzing the probability models arising in engineering field.
- Make use of the correlation and regression analysis to fit a suitable mathematical model for the statistical data.
- Construct joint probability distributions and demonstrate the validity of testing the hypothesis.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.

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4	A Text Book of Engineering Mathematics	N. P. Bali and Manish Goyal	Laxmi Publications	2014
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2. http://www.class-central.com/subject/math(MOOCs)
3. http://academicearth.org/
4. VTU EDUSAT PROGRAMME - 20

B. E. Common to all Programmes
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SEMESTER - IV

ADDITIONAL MATHEMATICS – II

(Mandatory Learning Course: Common to All Programmes)
(A Bridge course for Lateral Entry students under Diploma quota to BE/B. Tech. programmes)

Course Code	**18MATDIP41**	CIE Marks	40
Teaching Hours/Week (L:T:P)	(2:1:0)	SEE Marks	60
Credits	**0**	Exam Hours	03

Course Learning Objectives:

- To provide essential concepts of linear algebra, second & higher order differential equations along with methods to solve them.
- To provide an insight into elementary probability theory and numerical methods.

Module-1

Linear Algebra: Introduction - rank of matrix by elementary row operations - Echelon form. Consistency of system of linear equations - Gauss elimination method. Eigen values and Eigen vectors of a square matrix. Problems.

Module-2

Numerical Methods: Finite differences. Interpolation/extrapolation using Newton's forward and backward difference formulae (Statements only)-problems. Solution of polynomial and transcendental equations – Newton-Raphson and Regula-Falsi methods (only formulae)- Illustrative examples. Numerical integration: Simpson's one third rule and Weddle's rule (without proof) Problems.

Module-3

Higher order ODE's: Linear differential equations of second and higher order equations with constant coefficients. Homogeneous /non-homogeneous equations. Inverse differential operators.*[Particular Integral restricted to R(x)=* e^{ax}, sin *ax* /cos *ax for* $f(D)y = R(x)$.]

Module-4

Partial Differential Equations (PDE's):- Formation of PDE's by elimination of arbitrary constants and functions. Solution of non-homogeneous PDE by direct integration. Homogeneous PDEs involving derivative with respect to one independent variable only.

Module-5

Probability: Introduction. Sample space and events. Axioms of probability. Addition & multiplication theorems. Conditional probability, Bayes's theorem, problems.

Course Outcomes: At the end of the course the student will be able to:
CO1: Solve systems of linear equations using matrix algebra.
CO2: Apply the knowledge of numerical methods in modelling and solving engineering problems.
CO3: Make use of analytical methods to solve higher order differential equations.
CO4: Classify partial differential equations and solve them by exact methods.
CO5: Apply elementary probability theory and solve related problems.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

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OPEN ELECTIVE-A

B.E (OPEN TO ALL PROGRAMMES OF ENGINERRING)
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - VI

OPEN ELECTIVE-A

LASER PHYSICS AND NON-LINEAR OPTICS (18PHY651)

Course Code	**18PHY651**	CIE Marks	40
Teaching Hours/Week (L:T:P)	(3:0:0)	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:
This course will

- Enable the students to understand the mode of working of different types of Laser with relevant theoretical background
- Benefit to identify the applications of laser in various fields
- Support to learn the fundamentals of optical fiber materials and various fabrication methods
  Assist to recognize the relevance of NLO in Laser technology and learn its fundamentals

Module-1

Theory of Vibrations and Resonance:
Equation for simple harmonic motion, Differential equation for SHM, Free vibrations, natural frequency of vibration, Damped vibration, Analytical treatment of Damped vibration, Cases of Over damping, critical damping & Under damping, Forced Vibrations, Analytical treatment of forced vibrations, condition for resonance, sharpness of resonance, Applications of resonance: Takoma Bridge collapse, Laser cavity resonance. Numerical problems.

Module-2

Laser:
Review of basic principles, Types of Laser: Nd-YAG Laser, Liquid Laser, Dye Laser (Rhodamine 6-G), Chemical Laser (HF Laser), Qualitative discussion of Free electron Laser and X-ray Laser, Laser amplifiers.
Numerical problems.

Module-3

Applications of Lasers:
Defence applications: Laser range finder and Laser guided antitank missile,
Industrial applications: Data storage and Laser printing,
Research and development applications: Lithography, Laser cooling, Laser fusion and isotope separation.
Detection of pollutants in the atmosphere using laser (LIDAR)
Biomedical applications: Eye surgery, Endoscopy and Dentistry

Module-4

Optical Fiber Communication:
Review of basic principles of Optical fibers, fiber materials, fiber fabrication, Vapor-deposition methods, Fiber optic cables, optical fiber connections, joints and couplers, attenuation and dispersion in optical fibers, Industrial, medical and technological applications of optical fiber, Fiber optic sensors -Intensity modulated, phase modulated and polarization modulated sensors.
Numerical problems.

Module-5

Nonlinear Optics:
Relevance of Nonlinear optics in Laser technology, descriptions of nonlinear optical processes, formal definition of the nonlinear susceptibility, nonlinear susceptibility of a classical anharmonic oscillator, properties of the nonlinear susceptibility, time-domain description of optical nonlinearities, Mention of Kramers–Kronig relations in linear and nonlinear optics. The wave equation for nonlinear optical media, sum-frequency generation, second-harmonic generation, difference-frequency generation and parametric amplification¸ optical parametric oscillators.
Numerical problems.

Course outcomes: At the end of the course the student will be able to:

CO 1: Distinguish and analyze different types of vibrations.
CO 2: Understand fabrication and working of different types of Lasers.
CO 3: Learn the applications of Lasers in various fields.
CO 4: Acquire the knowledge of optical fibers and their applications in sensor designing.
CO 5:Apprehend the basics of nonlinear optics phenomena through the fundamentals of quantum mechanics

Question paper pattern:

The question paper will be set for 100 marks and the marks obtained by the student is reduced to 60

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Sl No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Engineering Physics	R. K. Gaur and S. L. Gupta	Dhanpath Rai and Sons	2006
2	Lasers: Theory and Applications	K. Thyagarajan and A.K. Ghatak	Springer	1981
Reference Books				
3	Laser and Fundamentals	W. T. Silfvast	Cambridge University Press	2004
4	Essentials of Nonlinear optics	Y.G.S. Murthy and C. Vijayan	Wiley Publications	2012
5	Lasers and Nonlinear optics	B. B. Laud	John Wiley & Sons Inc	2014

B.E (OPEN TO ALL PROGRAMMES OF ENGINERRING)
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - VI

OPEN ELECTIVE-A

APPLIED CHEMISTRY FOR ENGINEERS

Course Code	**18CHE652**	CIE Marks	40
Teaching Hours/Week (L:T:P)	(3:0:0)	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- This course will explore applications of chemistry which includes polymers, surfactants, nanomaterials, environmental and green chemistry, biomolecules and analytical techniques.

Module-1

Polymers: Introduction, types of polymerisation. Mechanism of polymerization of ethylene. Molecular weight, numerical problems. Glass transition temperature – Crystallinity, melting point. Viscoelasticity. Elastomers-structure, applications and curing. Conducting polymers and applications. Solubility of polymers. Fabrication and moulding of polymers. Synthesis, properties and uses of PVC, PMMA. Resins: Synthesis, properties and uses of urea - formaldehyde and phenol - formaldehyde. Composites: types and applications. Metallic and nonmetallic fillers.

Module-2

Surfactants and Lubricants: Methods of preparation, cleaning mechanism. Critical micelle concentration and its determination. Hydrophobic and hydrophilic interactions. Micelles and reverse micelles. Detergents. Fricohesity of surfactants. Lubricants-physical and chemical properties, types and mechanism of lubrication. Additives of lubricants and freezing points of lubricants.

Corrosion: Thermodynamic overview of electrochemical processes. Reversible and irreversible cells. Chemical and electrochemical corrosion and mechanism of corrosion. Factors affecting corrosion. Protection of corrosion and practical problems of corrosion.

Module-3

Nanomaterials: Introduction to nanomaterials. Properties and applications of fullerenes, fullerols, carbon nanotubes and nanowires. Synthesis-top down and bottom up approaches. Nanoelectronics. Applications of nanomaterials in catalysis, telecommunication and medicine.

Metals and Alloys: Phase rule and applications of one, two and multi-component systems. Iron-carbon phase diagram. Types of alloys, carbon steel, alloy steel, alloys of Cu, Al, Pb.

Module-4

Environmental and Green Chemistry: Air, water and noise pollution. Optimum levels of pollution. Significance and determination of COD and BOD. Solid waste treatment of collection of NKP. Greenhouse effect/global warming. e-Waste. Radioactive pollution. Applications of green chemistry and green technology. Concept of atomic and molecular economy and its use in green chemistry.

Modern Analytical Techniques: Mass spectrometry. Thermal analysis. Electron microscopy, scanning tunneling microscope and atomic force microscope. Sensors. Lab-on-a-chip.

Module-5

E**nergy Science:** Petroleum refining, liquid fuels, anti-knock agents. Cracking of oils. Limitations of fossil fuels. Alternative and non-conventional sources of energy – solar, wind, geo, hydro-power and biomass. Advantages and disadvantages. Nuclear energy, reactors and nuclear waste disposal. Safety measures for nuclear reactors.

Course Outcomes: At the end of the course, students are able to:

CO1: Apply the principles of Polymer Chemistry in industrial applications.
CO2: Understand the structures of different types of molecules in lubrication and corrosion
CO3: Distinguish between nanomaterials, metals and alloys.
CO4: Use classical methods of gravimetric and volumetric analysis through analytical techniques.
CO5: Apprehend the need of non-conventional energy sources.

Question paper pattern:

Note:- The SEE question paper will be set for 100 marks and the marks scored by the student will be proportionately reduced to 60.

- The question paper will have **ten** full questions carrying equal marks.
- Each full question carries **20** marks.
- There will be **two** full questions (with a **maximum** of **three** sub questions) from each module.
- Each full question will have sub question covering all the topics under a module.

The students will have to answer **five** full questions, selecting **one** full question from each module

Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Introduction to Nano Science	S. M. Lindsay	Oxford	2009
2	A Textbook of Engineering Chemistry	Shashi Chawla	Dhanpat Rai & CO	2013
Reference Books				
3	Engineering Chemistry	P. C Jain and M. Jai	Dhanpat Rai & CO	2013
4	Advanced Polymer Chemistry	M. Chanda	New York : Marcel Dekker	2000
5	A Textbook of Environmental Chemistry	O. D. Tyagi and M. Mehra	Anmol Publications Pvt Ltd	1990

B.E (OPEN TO ALL PROGRAMMES OF ENGINERRING)
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SEMESTER - VI

OPEN ELECTIVE-A

ADVANCED LINEAR ALGEBRA

Course Code	**18MAT653**	CIE Marks	40
Teaching Hours/Week (L:T:P)	(3:0:0)	SEE Marks	60
Credits	**3**	Exam Hours	03

Course Learning Objectives:

- To familiarize the important tools of linear algebra, that are essential in all branches of engineering.
- To develop the knowledge/skills of linear transformation and decomposition techniques in a comprehensive manner.

Module-1

Linear Equations: Consistent and inconsistent systems and its solution sets; LU-decomposition.
Vector Spaces: Vector spaces; subspaces; Linearly independent and dependent vectors; Bases and dimension; coordinate vectors; computations concerning subspaces-Illustrative examples.

Module-2

Linear Transformations: Linear transformations; algebra of transformations**;** representation of transformations by matrices; linear functional; Non singular Linear transformations**;** inverse of a linear transformation; Problems on Rank-Nullity theorem.

Module-3

Inner Product Spaces: Inner products; inner product spaces; orthogonal sets and orthogonal projections; Gram-Schmidt orthogonalization process; QR- decomposition.

Module-4

Introduction to Spectral Theory: Eigen values and eigenvectors; Diagonalization; quadratic Forms, constrained optimization; Singular value decomposition.

Module-5

Engineering Applications:
i**)** Graphs and Networks (Article No:10.1, P.No:452-461, Text No. 2).
ii) Matrices in Engineering (Article No:10.2, P.No:462-473, Text No. 2).
iii) Computer Graphics.(Article No:10.9, P.No:596-602, Ref No. 3).

Course outcomes: At the end of the course the student will be able to:

CO1: Demonstrate the applications of numerical methods to find the roots of polynomial equations and eigen values of real symmetric matrices.
CO2: Apply various numerical methods for solving linear partial differential equations arising in engineering field.
CO3: Develop expansion of functions of complex variables in terms of Laurent's series, explain ideas related to the calculus of residues and contour integration.
CO4: Understand the facts related hypothesis testing and analyze the analysis of variancefor larger samples.
CO5: Apply the knowledge of stochastic process, queuing theory, in solving problems arising in various physical and engineering phenomena.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Sl No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
Textbook/s				

1	Linear Algebra and its Applications	David C. Lay	Cambridge University Press	3rd Edition, 2017.
2	Introduction to Linear Algebra	Gilbert Strang	Wellesley-Cambridge Press	5th Edition, 2016.
Reference Books				
3	Introductory Linear Algebra with Applications	Bernard Kolman and David R. Hill	Pearson Education (Asia) Pvt. Ltd	7th Edition, 2003
4	Linear Algebra	Kenneth Hoffman andRay Kunze	Pearson Education (Asia) Pte. Ltd, 2004.	2nd Edition, 2004
5	Elementary Linear Algebra - Applications Version	Howard Anton and Chris Rorres	Wiley, 2014	11th Edition, 2014

B.E (OPEN TO ALL PROGRAMMES OF ENGINERRING)
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - VII

OPEN ELECTIVE - B

ADVANCED PHYSICS FOR ENGINEERS (18PHY751)

Course Code	**18PHY751**	CIE Marks	40
Teaching Hours/Week (L:T:P)	(3:0:0)	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

This course will Enable the students to

- Learn Quantum mechanics, Raman spectroscopy and its theoretical background with applications
- Explore the fundamentals of Quantum computation
- Recognize Nuclear and environmental hazards with their implications
- Understand Special theory of relativity and its relevance in latest applications

Module-1

Raman Spectroscopy:

Scattering of light, Coherent and incoherent scattering with examples. Raman effect, Stoke's and anti Stoke's lines, Characteristics of Raman spectra, Experimental study of Raman effect, Classical and Quantum theory of Raman effect.

Different energy levels in molecules, Mention of the expression for vibrational energy and rotational energy of a diatomic molecule, Rotational and Vibrational Raman spectra (qualitative)

Applications of Raman spectroscopy (qualitative), Detailed discussion of role of Raman spectroscopy in Forensic science, Environmental studies and Industrial applications, Numerical Problems

Module-2

Quantum Mechanics:

Operator formalism of Schrodinger equation (time dependent Schrodinger equation- Hamiltonian), Expectation values, Applications of Schrodinger's equation: Step potential - Determination of reflection and transmission coefficients when the energy of incident particles is (i) greater than the height of step potential (E > Vo) (ii) less than the height of step potential ($E<V_o$). Rectangular potential barrier, Barrier penetration and quantum mechanical tunnelling, Tunnelling probability (T), Applications of tunnelling: Scanning Tunnelling microscope (STM), Alpha decay, Tunnel diode.

quantum structures, comparison with normal structures and quantum structure.

Module-3

Quantum Computing:

Introduction to quantum computation, Classical information and quantum information, Moore's law, Maxwell's demon and Szilard's simplified model, Landauer's principle, Idea of reversibility, Superposition in quantum computation with examples (Qualitative), Concept of Qubit, Properties of Qubit-vector representations in qubit states, Superposed spin states of electron, Quantum amplitudes, rotations, Hadamord transformation, Toffoli gate, Examples of quantum computing through NMR system, Difference between classical and quantum computing.

Module-4

Environmental and Nuclear Hazards:

Environmental Hazards: Regions of atmosphere based on vertical temperature profile, Tropospheric greenhouse gases- O_3, NO, NO_2, CO, CO_2, CH_4 and non CH_4, atmospheric aerosol particles, role of trace gases and aerosols in atmospheric energy balance. Effect of anthropogenic activities on trace gases and aerosols, surface warming, climate change, stratospheric ozone, effect of CFC's on stratospheric ozone, ozone hole.

Nuclear Hazards: Radiation: Ionizing radiation and its effects, Mutation: Genetic load, mutation rates, Background radiation, Units of radiation: Roentgen and rad, Relative biological effectiveness (RBE), Roentgen equivalent man (REM), Man-made radiation: X-Rays, Nuclear radiation, Radiation sickness, Absorption of radiation by biological beings. Numerical Problems.

Module-5

Special Theory of Relativity:
Frames of reference, Galilean transformations, Michelson and Morley experiment-significance of negative result of the experiment, Postulates of Einstein's theory of relativity, Lorentz transformation equation -space and time, Length contraction and time dilation, Velocity addition theorem. Relativistic expression for variation of mass with velocity, mass with energy of a particle in terms of momentum. Equivalence of mass and energy, Relevance of special theory of relativity in GPS. Numerical Problems**.**

Course Outcomes: At the end of the course the student will be able to:
CO 1. Apply the concept of Raman spectroscopy to various fields including medicine.
CO 2: Utilize the principles of quantum mechanics in tunnelling problems.
CO 3: Understand the developments in modern computing.
CO 4: Identify the basic environmental and nuclear hazards.
CO 5: Distinguish between relativistic and non-relativistic motion and its relevance to terrestrial communication

Question paper pattern:
The question paper will be set for 100 marks and the marks obtained by the student is reduced to 60

- The question paper will have ten full questions carrying equal marks.
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- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Sl No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Concepts of Modern physics	Arthur Beiser	McGraw-Hill Publishing	2006
2	Fundamentals of Molecular Spectroscopy	Colin N. Banwell and Elaine M.	McGraw-Hill Publishing	2006
Reference Books				
3	Spectroscopy	H. Kaur	Pragati Prakashan, Meerut.	2011
4	Quantum computation and quantum information	M.A. Nielsen and I.L. Chuang	Cambridge University Press	2012
5	Chemistry and Physics of Air pollution and climate change	John. H. Seinfield	Wiley	2011

B.E (OPEN TO ALL PROGRAMMES OF ENGINERRING)
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - VII

OPEN ELECTIVE-B

ADVANCED POLYMER CHEMISTRY FOR ENGINEERS

Course Code	**18CHE752**	CIE Marks	40
Teaching Hours/Week (L:T:P)	(3:0:0)	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives: This course

- Introduce the concepts of polymer science to investigate the synthesis, physical properties and kinetics of polymers.
- Explore the conformations and transitions using thermodynamic equilibrium and kinetics.

Module-1

Introduction to polymers: Definitions, origin, classification of Polymers; molecular weight (MW), Determination of molecular weight – methods for measuring number average, weight average, viscosity average MW; gel permeation chromatography; spectroscopic techniques to determine chemical composition and molecular microstructure. Colligative properties, osmotic pressure, light scattering, refractive index, viscosity, small angle X-ray scattering.

Module-2

Mechanism and kinetics of polymerization: Step-Growth Polymerization: Reactivity of functional groups; kinetics; molecular weight in open and closed system cyclisation vs. linear polymerization, cross-linking and gel point; process condition. Free radical Polymerization: Nature of chain polymerization and comparison of step polymerization; radical and ionic polymerizations; kinetics of chain polymerization; chain transfer, inhibition, retardation, auto-acceleration; energetic characteristics; techniques of radical polymerization – bulk, solution, emulsion and suspension polymerization.

Module-3

Ionic Polymerization and Biopolymers: Propagation and termination of cationic polymerization, anionic and ring opening polymerization, active polycarbanions. Copolymerization: types of copolymers, copolymer compositions, reactivity ratio; radical and ionic co-polymerizations; Block and Graft copolymer synthesis, examples. Chemistry and synthesis of bio polymers, industrial applications. Production of smart polymers with examples.

Module-4

Thermodynamics of polymer solutions: Flory-Huggins theory, theta conditions; solubility parameters; fractionation of macromolecules, osmotic pressure, lower critical solution temperature. Naturally occurring polymers, biodegradability, biosynthesis, polymers from renewable resources.

Module-5

Polymers for Electronics: Polymer resists for integrated circuit fabrication, lithography and photolithography, Electron beam, X-ray and ion sensitive resists, Conducting polymers, types, properties and applications, electroluminescence, molecular basis of electrical conductivity, Photonic applications and non-linear optics, optical information storage. Fibres: Polyesters, mechanical requirements for fibers, drawing, orientation and crystallinity, stress strain curves; Carbon fibres and nanotubes, Polymer blends and composites: characteristics, types and applications; Polymer films in sensor applications.

Course Outcomes: After studying this course, the students are able to:

CO1: Relate polymer properties to their structure and conformation.
CO2: Analyze the mechanism of polymer formation and synthesis.
CO3: Distinguish between enthalpic and entropic contributions to polymerization.
CO4: Understand the thermodynamics of polymer solutions
CO5: Apply the knowledge of polymers for engineering applications.

Question paper pattern:

Note:- The SEE question paper will be set for 100 marks and the marks scored by the student will be proportionately reduced to 60.

- The question paper will have ten full questions carrying equal marks.
- Each full question carries 20 marks.
- There will be two full questions (with a maximum of three sub questions) from each module.
- Each full question will have sub question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Introduction to Physical Polymer Science	L. H. Sperling	Wiley	2005
2	Introduction to Soft matter	I. W. Hamley	John Wiley and Sons	2007
3	Principles of Polymer Chemistry	P. J. Flory	Cornell University Press	1953
Reference Books				
4	Polymer chemistry and Physics of Modern Materials,	J. M. G. Cowie	Stanley Thornes, UK	1998
5	Contemporary Polymer Chemistry	H. R. Allcock, F. W. Lampe and J. E. Mark	Pearson	2004
6	Polymers: Chemistry and Physics of Modern Materials	M.G. Cowie	CRC Press	2007

B.E (OPEN TO ALL PROGRAMMES OF ENGINERRING)
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SEMESTER - VII

OPEN ELECTIVE-B

ADVANCED MATHEMATICAL METHODS

Course Code	**18MAT753**	CIE Marks	40
Teaching Hours/Week (L:T:P)	(3:0:0)	SEE Marks	60
Credits	**3**	Exam Hours	03

Course Learning Objectives:

- To familiarize the important tools of advanced numerical methods and complex analysis, required to analyze the engineering problems.
- To apply the knowledge of statistical techniques, stochastic process and queuing theory to offer solutions the engineering problems.

Module-1

Numerical Methods-1:-
Eigen values of real symmetric matrices- Givens method and Householder's method. Roots of polynomial equations-Birge-Vieta method and Bairstow's methods.

Module-2

Numerical Methods-2:-
Numerical solution for PDE's:-Numerical solution for PDE's:- Numerical solution of Laplace and Poisson's equations . Numerical solution of heat equation by Smith and Crank-Nicolson method.
Numerical solution of wave equations explicit method.

Module-3

Complex Analysis:-Taylor's and Laurent series expansion of analytic functions-problems. The calculus of residues-Singularities based on Laurent's series expansion, Cauchy's residue theorem-problems. Contour integration-evaluation of real definite integrals.

Module-4

Descriptive Statistics- Sampling and testing the statistical hypothesis. Test of significance and confidence intervals. Estimation theory. Analysis of variance. F-distribution and F-test related to one way classification with/without interactions, problems related to ANOVA-I.

Module-5

Stochastic Process: Classification of stochastic process with examples. Markov chain and related problems.
Queuing theory- Poisson queuing system, Little law. Discussion of M/M/1 and M/M/s queuing models.

Course outcomes: At the end of the course the student will be able to:
CO1: Analyze whether a system is consistent or inconsistent, its solution is unique or infinite and find bases and dimension of vector spaces required in network analysis.
CO2: Linearly transform the system from one dimension to another in matrix form ,required to analyze image processing problems.
CO3: Compute orthogonal and orthonormal basis vectors required to analyze image and signal processing problems.
CO4: Apply techniques of constrained optimization and singular value decomposition for problems arising in control system analysis, signals and systems.
CO5: Apply linear algebraic tools to analyze problems in graphs and networks problems, computer graphics.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Sl.	Title of the Book	Name of the	Name of the	Edition and Year

No.		Author/s	Publisher	
Textbook/s				
1	Mathematical Methods for Physics and Engineering	K.F. Riley, M.P.Hobson and S.J.Bence	Cambridge University Press	3rd Edition, 2017.
2	Advanced Engineering Mathematics	E. Kreyszig	John Wiley & Sons	10thEd.,(Reprint), 2017.
3	Probability, Statistics and Random Process	T.Veerarajan	Tata Mc-Graw Hill Co.	3rd Edition, 2016
Reference Books				
1	Probability, Queuing Theory and Reliability Engineering	G.Haribasharan	Laxmi Publications, New Delhi	2ndEdition, 2006
2	Higher Engineering Mathematics	B.S. Grewal	Khanna Publishers.	44thEdition, 2017
3	Introductory Methods of Numerical Analysis	S.S.Sastry	Prentice Hall of India	4th Edition, 2011
4	Numerical Methods for Scientific and EngineeringComputation	M.K.Jain, S.R.K.Iyengar and R.K.Jain	New Age Int.Publishers	6th Edition, 2014
5	Probability and Random Processes	G.R.Grimmet and D.R.Stirzaker	Oxford University Press	3rd Edition, 2001