

**KANNUR UNIVERSITY**  
**CURRICULUM & SYLLABUS**  
With effect from 2007 Admission

**B.Sc (MATHEMATICS)**

# KANNUR UNIVERSITY

## B.Sc (MATHEMATICS)

### CURRICULUM

**B.Sc (Mathematics Main)** is a widely accepted prestigious course for intelligent and motivated students who intent to pursue a career in Mathematics and Mathematics related fields. This course spread over THREE academic years.

Mathematics shall be the main subject of this course. Besides English , Second Language and main subject , there will be two subsidiary subjects also, of which one is compulsory and the other is optional. At present Statistics is the compulsory Subsidiary for this course.

In addition to the instructional hours, TUTORIAL WORK shall be done. Tutorial hours shall supplement class room teaching and it includes subject related problem solving, seminars, Computer software usage, Internet searching etc.

## REGULATIONS FOR B.Sc (Mathematics Main)

### **ELIGIBILITY FOR ADMISSION**

Candidates for admission to B.Sc(Mathematics Main) course shall be required to have a minimum grade qualification with one paper MATHEMATICS in Higher Secondary ( Plus Two, VHSC, CBSC XII etc ) or equivalent examinations stipulated by Kannur University .

### **INDEXING MARKS FOR ADMISSION**

General regulations of B.Sc of Kannur University (Criteria for Pattern I) will be followed for indexing marks for admission..

### **SCHEME OF EXAMINATIONS**

#### **B.Sc Mathematics Main**

There shall be EIGHT papers for Part III – Mathematics Main .FIVE papers are common core subjects and THREE papers are electives. One elective is to be chosen from each of the groups GROUP A, GROUPB, and GROUP C. However those batches having Computer Science as a subsidiary shall not choose an elective from GROUP C. They have to choose three electives from among GROUP A and GROUP B ( Two electives from one group and one elective from the other group)

Total marks for these eight papers will be 600. Of this 120 marks will be awarded through INTERNAL EVALUATION 480 marks will be awarded though EXTERNAL EXAMINATION.

Examination of Paper I is to be conducted at the end of First year of the course and that of Paper II at the end of Second year.

Examinations of Paper III, Paper IV, Paper V , Paper VI (Elective ),Paper VII (Elective ) and Paper VIII(elective ) are to be conducted at the end of THIRD year.

Besides these papers, ENVIRONMENTAL STUDIES is also to be taught in THIRD year. Teaching of this paper for B.Sc ( Mathematics main)is the responsibility of the concerned Dept of Mathematic. Instructional hours for this paper is 30. For this paper, the common syllabus accepted by Kannur University will be followed.

An internal examination for 100 marks is to be conducted for this paper by the concerned department. Minimum marks for a pass in this paper is 35. No student shall be declared to have passed the degree course without passing the paper on environmental studies. However the marks for this paper shall not be considered for arriving at pass minimum, ranking etc under Part III.

### **B.Sc Mathematics Subsidiary**

B.Sc Mathematics (Subsidiary ) shall have TWO Papers. Examination of Paper I is to be conducted at the end of First year and examination of Paper II at the end of Second Year. Total mark for Subsidiary Mathematics is 200. Of this 40 marks will be awarded through INTERNAL EVALUATION and 160 marks will be awarded though EXTERNAL EXAMINATION.

### **ATTENDANCE**

For appearing the examinations , students shall have minimum 75% attendance of the total working days

### **ASSIGNMENTS**

Students are required to do at least one assignment for each unit of each paper. Assignments may include different types of problems assigned by the concerned teachers. Valued assignments are to be returned to the students.

### **TESTS**

For each paper at least THREE class tests are to be conducted. Average of best two tests is to be considered for awarding internal marks. Valued answer scripts of the tests shall be returned to the students.

### **SEMINAR/ORAL TEST**

Seminars and oral tests shall be conducted for each paper as part of internal evaluation. Selection of students for this shall be at random.

**KANNUR UNIVERSITY**  
**B.Sc(Mathematics Main )**  
**SYLLABUS AND EXAM SCHEME**  
**EFFECTIVE FROM 2007 ADMISSION.**

There are EIGHT papers for Part III Mathematics Main. Five papers are common and THREE are electives. One elective is to be chosen from each of the elective groups A, B and C. However those batches having COMPUTER SCIENCE as a subsidiary shall not choose an elective from Group C. They have to choose THREE electives from among Groups A & B(Two electives from one group and one from the other. Maximum marks for each paper is 75.

Paper Number	Name of the paper	Teaching Hours	Internal marks	Ext-Exam Hours	Marks Agg: Max
Paper I	Algebra, Trigonometry and Calculus	120	15	3	95 60
Paper II	Vector Analysis and Coordinate Geometry	150	15	3	95 60
Paper III	Mathematical Analysis	120	15	3	95 60
Paper IV	Differential Equations, Transforms, Fourier Series And Numerical Methods	120	15	3	95 60
Paper V	Abstract Algebra and Linear Programming	120	15	3	95 60
Paper VI (Elective) Group A	A1. Mechanics A2. Wavelets A3. Topology	120	15	3	95 60
Paper VII (Elective) Group B	B1. Operations Research B2. Mathematical Modeling B3. Discrete Mathematics	120	15	3	95 60
Paper VIII (Elective) Group C	C1. Principles of Computer Science	120	15	3	95 60

	Th * Pr	Th Pr	Th Pr	Th Pr
C2. Computer Fundamentals and C Language	90 30	10 5	2 1	40 20
C3. Programming With JAVA	90 30	10 5	2 1	40 20

\* Th: Theory, Pr : Practical

**Environmental Studies(30 Hours)**

Internal Examination : 3 Hours      Marks 100      Pass minimum 35

**SYLLABUS OF B. SC. DEGREE (MATHEMATICS MAIN) OF KANNUR  
UNIVERSITY WITH EFFECT FROM 2007 ADMISSION**

**PAPER I**

**ALGEBRA, TRIGONOMETRY AND CALCULUS**

This paper is divided into THREE units as detailed below.

Unit	Topic	Teaching Hours	Aggregate Marks	Maximum Marks
Unit I	Algebra and Trigonometry	40	30	20
Unit II	Differential Calculus	50	40	25
Unit III	Integral Calculus	30	25	15
<b>Total</b>		<b>120</b>	<b>95</b>	<b>60</b>

**UNIT I - ALGEBRA AND TRIGONOMETRY**

**Algebra**

**Text:** Bernard and Child, Higher Algebra.

Statement of the fundamental theorem of Algebra – Deduction that every polynomial of degree  $n$  has  $n$  and only  $n$  roots – Relation between zeros and coefficients of polynomials.

**Matrices**

**Text:** Narayan, S., Matrices.

Rank of a matrix – Elementary transformations – Reduction to normal and echelon forms – Consistency and solution of systems of linear equations – Characteristic equation of a matrix – Eigen values and eigen vectors – Cayley-Hamilton theorem.

**Trigonometry**

**Text:** Loney, S.L., Plane Trigonometry.

Circular and hyperbolic functions of a complex variable – separation into real and imaginary parts.

**UNIT II - DIFFERENTIAL CALCULUS**

**Text:** Sastry, S.S., Engineering mathematics, Vol. I.

Quick review of differentiation and partial differentiation – Change of variables – Polar, cylindrical and spherical coordinates – Higher derivatives and Leibnitz theorem – Exponential and logarithmic functions – Inverse circular functions – Derivatives of hyperbolic functions.

**Applications of differentiation:** Rolle's theorem and Mean value theorems - Maxima and minima of functions of two variables – convexity and points of inflection – Taylor's series, Maclaurin's series – Curvature – Asymptotes and envelopes.

### UNIT III - INTEGRAL CALCULUS

**Text:** S.S. Sastry, Engineering mathematics, Vol. I.

Quick review of integration – Reduction formulae – Applications of definite integral – Area between two curves – Volumes and surfaces of revolution – Length of an arc of a curve.

**Double integrals:** Definition and evaluation of double integrals – Area by double integration – Triple integrals – applications of triple integrals.

#### References

- [1] Bali, P.N., Engineering mathematics.
- [2] Piskinov, Differential and integral calculus, MIR Publishers.
- [3] Ayres, F., Matrices, Schaum's series, Mc Graw Hill.
- [4] Wylie, C.R., Advanced engineering mathematics, Mc Graw Hill.

#### Distribution of internal marks

Attendance : 3 marks  
 Assignments : 6 marks  
 Tests/oral/seminar : 6 marks

### PAPER II VECTOR ANALYSIS AND COORDINATE GEOMETRY

This paper is divided into THREE units

Unit	Topic	Teaching Hours	Aggregate Marks	Maximum Marks
Unit I	Vector Analysis	50	30	20
Unit II	Two-Dimensional Geometry	50	30	20
Unit III	Three-Dimensional Geometry	50	35	20
<b>Total</b>		<b>150</b>	<b>95</b>	<b>60</b>

### UNIT I - VECTOR ANALYSIS

**Text:** Bedford, F.W. and Dwivedi, T.D., Vector calculus, McGraw Hill book company, NewYork.

**1. Differential vector calculus for curves:** Vector function of a single variable, limits, continuity and differentiation, unit tangent vector, unit normal vector, velocity and acceleration vectors.

∇ **Vector differential calculus for surfaces:** The gradient vector, directional derivative, unit normal vector to a surface, divergence and curl of vector function, laplacian operator  $\nabla^2$  identities involving  $\nabla$  .

**3. Vector integral calculus:** Line integrals in the plane, Green's theorem (without proof), surface integrals, divergence theorem (without proof), Stoke's theorem (without proof).

### UNIT II - TWO-DIMENSIONAL GEOMETRY

**Text:** Manicavachagam Pillay, Calculus and coordinate geometry.

Equations of tangents and normals of conics. Chords of contact of tangents from a point. Pair of tangents from a point. Pole. Polar. Conjugate points. Conjugate lines. Orthoptic locus. Equation of a chord in terms of middle point. Parametric representation of points on conics. Conjugate diameters of ellipse and hyperbola. Asymptotes of a hyperbola. Conjugate hyperbola. Rectangular hyperbola and its properties. Equations to tangents and normals to these curves.

### UNIT III - THREE-DIMENSIONAL GEOMETRY

**Text 1:** Sastry, S.S., Engineering mathematics, Vol. I (3<sup>rd</sup> edition), Prentice hall of India, NewDelhi (2004).

**Text 2:** Duraipandian, P., Duraipandian, L. and Muhilan, D., Analytical geometry – 3-dimensional, Emerald publishers, Chennai (2004).

**1. Cylindrical polar coordinates and spherical polar coordinates.** (Sections 2.1.6, 2.1.7 of text 1).

**2. Plane:** Second degree homogeneous equation, coplanarity of lines through a point, positions of points with respect to a plane, bisector planes of angles between two given planes, volume of tetrahedron. (Sections 3.6, 3.7, 3.9, 3.10, 3.11 of text 2).

**3. Straight lines:** Projection of a line, perpendicular drawn to a line, line intersecting a given line, lines of intersection of three planes, equations of two given skew lines, surface generated by a straight line. (Sections 4.4 to 4.10 except 4.6 of text 2).

**4. Sphere:** Results based on the properties of a sphere, tangent plane to a sphere, radical plane, equations of circle, equations  $S + \lambda P = 0$  and  $S + \lambda S' = 0$ . (Sections 5.3 to 5.7 of text 2).

**5. Cone:** Cone, equation of a cone, cone whose vertex is at the origin, quadric cone with vertex at the origin, general quadric cone. (Sections 6.1 to 6.5 of text 2).

**6. Cylinder:** Cylinder, equation of a cylinder. (Sections 6.6 and 6.7 of text 2).

#### References

[1] Davis, H.F. and Swider, A.D., Introduction to vector analysis (6<sup>th</sup> edition), Universal book stall, NewDelhi (1992).

[2] Lass, H., Vector and tensor analysis, Mc. Graw-Hill, Tokyo.

[3] Weatherburn, C.E., Advanced vector analysis, G. Bell & Sons Ltd., London (1966).

[4] Bell, R.J.T., An elementary treatise on coordinate geometry on three dimensions (3<sup>rd</sup> edition), MacMillan & Co. Ltd., NewYork (1959).

[5] Green, S.L., Algebraic solid geometry, Cambridge university press (1957).

[6] Pillay, T.K.M. and Natarajan, T., A text book of analytical geometry (Part II – three dimensions), S. Viswanathan printers & publishers Pvt. Ltd. (2001).

[7] Zameeruddin, Q. and Khanna, V.K., Solid geometry, Vikas publishing house, Pvt. Ltd., NewDelhi (1991).

**Distribution of internal marks:**

Attendance : 3 marks  
 Assignments : 6 marks  
 Tests/oral/seminar : 6 marks

**PAPER III**  
**MATHEMATICAL ANALYSIS**

This paper is divided into THREE units .

Unit	Topic	Teaching Hours	Aggregate Marks	Maximum Marks
Unit I	Real numbers, sequences and series	40	30	20
Unit II	Continuous functions and Riemann integrals	30	25	15
Unit III	Complex numbers, analytic functions, complex integrals, sequences and series, Laurent's series and integration by method of residues	50	40	25
<b>Total</b>		<b>120</b>	<b>95</b>	<b>60</b>

**UNIT I**

**Text:** Bartle, R.G. and Sherbert, D.R., Introduction to real analysis (2<sup>nd</sup> edition), John Wiley & Sons, Inc., NewYork.

**Real numbers:** The algebraic properties of  $\mathbf{R}$ , the order properties of  $\mathbf{R}$ , absolute value, the completeness property of  $\mathbf{R}$ , applications of the supremum property, intervals and decimals, infinite sets. (Chapter 2, sections 2.1 to 2.7)

**Sequences:** Sequences and their limits, limit theorems, monotone sequences, subsequences and the Bolzano-Weierstrass theorem, the Cauchy criterion (Chapter 3, sections 3.1 to 3.4)

**Infinite series:** Convergence of infinite series, tests for absolute convergence, tests for nonabsolute convergence. (Chapter 9, sections 9.1 to 9.3)

**UNIT II**

**Text:** Bartle, R.G. and Sherbert, D.R., Introduction to real analysis (2<sup>nd</sup> edition), John Wiley & Sons, Inc., NewYork.

**Continuous functions:** Continuous functions on intervals. (Chapter 5, section 5.3)

**Uniform continuity** (Chapter 5, sections 5.4.1, 5.4.2, 5.4.3, 5.4.14)

**The Riemann integral:** Riemann integrability, properties of the Riemann integral. (Chapter 7, sections 7.1, 7.2.1, 7.2.2, 7.2.3, 7.2.4)

**UNIT III**

**Text:** Kreyzig, E., Advanced engineering mathematics (8<sup>th</sup> edition).

**Complex numbers and functions:** Complex numbers, polar form of complex numbers, triangular inequality, curves and regions in the complex plane, limits, derivatives, analytic functions, Cauchy-Riemann equations, Laplace's equations. (Chapter 12, sections 12.1 to 12.4).

**Complex integrals:** Line integral in the complex plane, Cauchy's integral theorem (statement only), Cauchy's integral formula, derivatives of analytic functions. (Chapter 13, sections 13.1 to 13.4)

**Power series:** Sequences and series, convergence tests, power series. (Chapter 14, sections 14.1, 14.2)

**Laurent's series, residue integration:** Laurent's series, singularities and zeros, infinity residue integration method. (Chapter 15, sections 15.1 to 15.3)

### References

- [1] Goldberg, R, Methods of real analysis.
- [2] Manicavachagam Pilay, Calculus.
- [3] Apostole, T.M., Mathematical analysis.
- [4] Rudin, W., Principles of mathematical analysis.
- [5] Binmore, K.G., Mathematical analysis.
- [6] Kasana, H.S., Complex variables – theory and applications.
- [7] Mathews, J.H. and Howel, R.W., Complex analysis for mathematics and engineering.
- [8] Churchil, R.V., Complex variables and applications.
- [9] Ponnuswamy, Foundations of complex analysis.

### Distribution of internal marks:

Attendance	: 3 marks
Assignments	:6 marks
Tests/oral/seminar	:6 marks

## PAPER IV

### DIFFERENTIAL EQUATIONS, TRANSFORMS, FOURIER SERIES AND NUMERICAL METHODS

This paper is divided into THREE units.

Unit	Topic	Teaching Hours	Aggregate Marks	Maximum Marks
Unit I	First order ordinary differential equations and second order differential equations	35	30	20
Unit II	Fourier series, Fourier integral and partial differential equations	45	30	20
Unit III	Laplace transforms and numerical methods	40	35	20
<b>Total</b>		<b>120</b>	<b>95</b>	<b>60</b>

**Text:** Kreyzig, E., Advanced engineering mathematics (8<sup>th</sup> edition).

### **UNIT I - FIRST ORDER ORDINARY DIFFERENTIAL EQUATIONS AND SECOND ORDER DIFFERENTIAL EQUATIONS**

Basic concepts and ideas – Geometric consideration – Separable differential equations – Equations reducible to separable form – Exact differential equations – Integrating factors – Linear first order differential equations – Variation of parameters - Orthogonal trajectories – Picard's iteration method – Existence and uniqueness of solutions.

Homogeneous linear equations of second order – Homogeneous second order equation with constant coefficients – General solutions – Basis, initial value problems, real roots, complex roots, double roots – Differential operators – Cauchy equations – Nonhomogeneous linear equations – Solving nonhomogeneous linear equations – Solution by undetermined coefficients - Solution by variation of parameters – Systems of differential equations – Higher order linear differential equations - Higher order homogeneous equations with constant coefficients - Higher order nonhomogeneous equations.

( Chapter 1, sections 1, 2, 3, 5, 6, 8, 9; Chapter 2, sections 1, 2, 3, 4, 6, 8, 9, 10, 13, 14, 15 )

### **UNIT II - FOURIER SERIES, FOURIER INTEGRAL AND PARTIAL DIFFERENTIAL EQUATIONS**

**Fourier series:** Periodic functions, trigonometric series, Fourier series, functions having arbitrary period, even and odd functions, half range expansion.

**Fourier integral, Fourier transforms.**

**Partial differential equations:** Basic concepts, separation of variables, solution of wave equation by Fourier series, D'Alembert's solution of wave equation, one-dimensional heat equation - solution by Fourier series.

( Chapter 10, sections 1, 2, 3, 4, 8, 10; Chapter 11, sections 1, 3, 4, 5 )

### **UNIT III - LAPLACE TRANSFORMS AND NUMERICAL METHODS**

**Laplace transforms:** Laplace transforms, inverse transforms, linearity, Laplace transforms of derivatives and integrals, shifting on the s-axis, shifting on the t-axis, unit step function, differentiation and integration of transforms, convolution, partial fractions, periodic functions, further application.

**Numerical methods:** Introduction, solution of equations by iteration, finite differences, interpolation, Newton's forward interpolation, Newton's backward interpolation, Lagrange's interpolation. Numerical integration – rectangular rule, trapezoidal rule, Simpson's rule.

Numerical methods for first order differential equations – Euler method.

( Chapter 5, sections 1, 2, 3, 4, 5, 6, 7, 8; Chapter 17, sections 1, 2, 3, 5; Chapter 19, section 1)

#### **References**

- [1] Simmons, G.F., Differential equations with application and historical notes.
- [2] Murray Macmillan, Differential equations.
- [3] Spiegel, M.R., Fourier analysis, Schaum's series.
- [4] Sneddon, Elements of partial differential equations.
- [5] Spiegel, M.R., Laplace transforms, Schaum's series.

**Distribution of internal marks:**

Attendance : 3 marks  
 Assignments : 6 marks  
 Tests/oral/seminar : 6 marks

**PAPER V****ABSTRACT ALGEBRA AND LINEAR PROGRAMMING**

This paper is divided into THREE units.

Unit	Topic	Teaching Hours	Aggregate Marks	Maximum Marks
Unit I	Groups and rings	50	40	25
Unit II	Vector spaces	40	30	20
Unit III	Linear programming	30	25	15
<b>Total</b>		<b>120</b>	<b>95</b>	<b>60</b>

**UNIT I - GROUPS AND RINGS**

**Text:** Herstein, I.N., Topics in algebra (2<sup>nd</sup> edition), Wiley eastern limited.

**The integers** (Section 1.3)

**Group theory:** Definition of a group, some examples of groups, some preliminary lemmas, subgroups, a counting principle, normal subgroups and quotient groups, homomorphisms, permutation groups, Cayley's theorem (statement only).

(Sections 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7 (upto theorem 2.7.1), 2.10.

**Ring theory:** Definition and examples of rings, some special classes of rings.

(Sections 3.1 and 3.2)

**UNIT II - VECTOR SPACES**

**Text:** Kumaresan, S., Linear algebra – a geometric approach, Prentice Hall of India.

**Vector spaces:** Definition and examples, vector subspaces, basis and dimension of a vector space. (Sections 2.1, 2.2 and 2.3)

**Linear transformations:** Linear transformations, representation of linear maps by matrices, kernel and image of a linear transformation. (Sections 4.1, 4.2 and 4.3)

**UNIT III - LINEAR PROGRAMMING**

**Text:** Swaroop, K., Gupta, P.K. and Mohan, M., Operations research (12<sup>th</sup> edition), Sulthan chand & sons

**Mathematical formulation** - Simple examples – sections 2.1, 2.2

**Graphical solution** - Sections 3.2, 3.4, 3.5

**Simplex method** - Sections 4.1, 4.2 (results only), 4.3

**Duality in linear programming** - Sections 5.1, 5.2, 5.3 and related problems.

**Transportation problems** - Sections 10.1, 10.2, 10.3, 10.5, 10.8, 10.9, 10.10, 10.11, 10.12

**Assignment problems** - Sections 11.1, 11.3.

### References

[1] Hoffman, K. and Kunzi, R., Linear algebra (2<sup>nd</sup> edition).

[2] Iyer Jr, F., Modern algebra, Schaum's series. .

[3] Fraleigh, J.B., A first course in abstract algebra.

[4] Paria, G., Linear algebra.

[5] Kapoor, V.K., Operations research.

[6] Lumba, P., Linear programming.

### Distribution of internal marks:

Attendance : 3 marks  
 Assignments : 6 marks  
 Tests/oral/seminar : 6 marks

## PAPER VI

### ELECTIVE A1 – MECHANICS

This paper is divided into THREE units .

Unit	Topic	Teaching Hours	Aggregate Marks	Maximum Marks
Unit I	Statics	50	40	25
Unit II	Dynamics I	40	30	20
Unit III	Dynamics II	30	25	15
<b>Total</b>		<b>120</b>	<b>95</b>	<b>60</b>

**Text:** Loney, S.L., The elements of statics and dynamics, AITBS publishers and distributors, New Delhi.

### UNIT I - STATICS

Composition and resolution of forces - parallel forces - moments - couples - equilibrium of a particle under coplanar forces - equilibrium of rigid bodies acted upon by three forces - general conditions of equilibrium of a rigid body acted upon by a system of forces in one plane - centre of gravity - centre of gravity of a triangle , tetrahedron. General formula for the determination of the centre of gravity - centre of gravity of a cone, cylinder,

hemisphere. Stable and unstable equilibrium. Friction - laws of Friction - equilibrium on a rough inclined plane - virtual work - principle of virtual work for coplanar forces acting on a rigid body.

### UNIT II - DYNAMICS I

Motion of a particle on a line under constant force - vertical motion under gravity - simple harmonic motion – force – momentum – work, power, energy. Impulse of a force and impulsive forces. Law of conservation of momentum. Impact of elastic bodies. Principle of conservation of energy. Tangential and normal acceleration of a particle describing a plane curve. Constrained motion in a circle. Simple pendulum, conical pendulum. Radial and transverse components of velocity and acceleration. Central orbits – differential equation of a central orbit.

### UNIT III - DYNAMICS II

Moment of inertia – theorems on parallel and perpendicular axes. Motion of a rigid body rotating about a fixed axis – angular momentum. Kinetic energy of a rotating body. Compound pendulum. Kinetic energy of a rigid body moving in two dimensions. Motion of a sphere rolling on an inclined plane. Planetary motion – Kepler's laws.

### References

- [1] Narayan, S., Dynamics, Roc house and sons, Madras.
- [2] Dharmapadam, A.V., Dynamics, S. Viswanathan pvt. ltd., Madras.
- [3] Dharmapadam, A.V., Statics, S. Viswanathan pvt. ltd., Madras.
- [4] Duraipandian, P., Duraipandian, L. and Jayapragasan, M., Mechanics, S. Chand and company.

### Distribution of internal marks:

Attendance : 3 marks  
 Assignments : 6 marks  
 Tests/oral/seminar : 6 marks

### PAPER VI

### ELECTIVE A2 – WAVELETS

This paper is divided into THREE units .

Unit	Teaching hours	Aggregate marks	Maximum marks
Unit I	15	20	15
Unit II	15	25	15
Unit III	30	50	30
<b>Total</b>	<b>120</b>	<b>95</b>	<b>60</b>

**Text:** Frazier, M.W., Introduction to wavelets through linear algebra, Springer-Verlag,

**UNIT I**

1. Brief description on vector spaces, basis, linear transformations, matrices related to linear transformations, change of basis, diagonalization of linear transformations and matrices. (Brief discussion of sections 1.3, 1.4, 1.5)
2. Inner products, orthonormal basis, unitary matrices. (Section 1.6)

**UNIT II**

3. Definition and basic properties of the discrete Fourier transform. (Section 2.1)
4. Translation invariant linear transformations. (Section 2.2)

**UNIT III**

5. Construction of wavelets on  $Z_N$ , the first stage. (Section 3.1)
6. Construction of wavelets on  $Z_N$ , the iteration step. (Section 3.2)

**References**

- [1] Daubechies, I., Ten lectures on wavelets, CBMS-NSF Reg. conference series in applied mathematics, Philadelphia (1992).
- [2] Chui, C., An introduction to wavelets, Academic press, New York (1992).
- [3] Bachman, G., Narici, L. and Beckenstein, E., Fourier and wavelet analysis, Springer-Verlag, New York (2000).

**Distribution of internal marks:**

Attendance	: 3 marks
Assignments	: 6 marks
Tests/oral/seminar	: 6 marks

**PAPER VI****ELECTIVE A3 – TOPOLOGY**

This paper is divided into THREE units as detailed below.

Unit	Teaching hours	Aggregate marks	Maximum marks
Unit I	40	30	20
Unit II	40	30	20
Unit III	40	35	20
<b>Total</b>	<b>120</b>	<b>95</b>	<b>60</b>

**Text:** Munkres, J.R., TOPOLOGY A first course, Prentice hall of India, New Delhi.

### UNIT I

1. Topological spaces.
2. Basis for a topology.
3. The order topology.
4. The product topology on  $X \times Y$ .
5. The subspace topology.

(Chapter 2, sections 2.1, 2.2, 2.3, 2.4, 2.5)

### UNIT II

6. Closed sets and limit points.
7. Continuous functions.

(Chapter 2, sections 2.6, 2.7)

### UNIT III

8. Metric topology.
9. Connected spaces.
10. Connected sets in the real line.
11. Compact sets.
12. Compact sets in the real line.

(Chapter 2, sections 2.9, 2.10; Chapter 3, sections 3.1, 3.2, 3.5, 3.6)

### References

- [1] Willard, S., General topology, Addison-Wesley publishing company.
- [2] Dugundji, J., Topology, Allyn and Bacon, Boston.
- [3] Simmons, G.F., Topology and modern analysis, Tata McGraw hill company.

### Distribution of internal marks:

Attendance	: 3 marks
Assignments	: 6 marks
Tests/oral/seminar	: 6 marks

**PAPER VII - ELECTIVE B1  
OPERATIONS RESEARCH**

This paper is divided into THREE units.

Unit	Teaching hours	Aggregate marks	Maximum marks
Unit I	40	30	20
Unit II	50	40	25
Unit III	30	25	15
<b>Total</b>	<b>120</b>	<b>95</b>	<b>60</b>

**Text:** Swarup, K., Gupta, P.K. and Mohan, M., Operations research (12<sup>th</sup> edition), Sulthan chand & sons, New Delhi (2004).

**UNIT I**

**Nature and use of O.R.:** Origin and development of O.R., nature and features of O.R., modeling in O.R., general solution, methods of O.R. models, scientific method in O.R., methodology of O.R., applications of O.R. (Sections 1.1 to 1.7).

**Extrema of functions:** Convex functions, local and global extrema. (Sections 0.15 and 0.16)

**Quadratic forms** (Section 0.17)

**Integer programming:** Introduction, Gomory's All-I.P.P. method, construction of Gomory's constraints, fractional cut method – all integer, fractional cut method – mixed integer, branch and bound method, applications of integer programming. (Sections 7.1 to 7.7)

**Sequencing problem:** Introduction, problem of sequencing, basic terms used in sequencing, processing  $n$  jobs through two machines, processing  $n$  jobs through  $k$  machines, processing 2 jobs through  $k$  machines, maintenance crew scheduling. (Sections 12.1 to 12.7)

**UNIT II**

**Dynamic programming:** Introduction, the recursive equation approach, characteristics of dynamic programming, dynamic programming algorithm, solutions of discrete D.P.P., some applications, solution of L.P.P. by dynamic programming. (Sections 13.1 to 13.7)

**Games and strategies:** Introduction, two-person zero-sum games, some basic terms, the maximin-minimax principle, games without saddle points – mixed strategies, graphic solution of  $2 \times n$  and  $n \times 2$  games, dominance property, arithmetic method for  $n \times n$  games. (Sections 17.1 to 17.8)

**Queuing theory:** Introduction, queuing system, elements of a queuing system, operating characteristics of queuing system, probability distributions in queuing systems, classification of queuing models, definition of transient and steady states, Poisson queuing systems. The M/M/1 Queue-model I, II, III, IV, V and VI. (Sections 20.1 to 20.8)

**UNIT III**

**Network scheduling by PERT / CPM:** Introduction, network and basic components, logical sequencing, rules of network construction, critical path analysis, probability considerations in PERT, distinction between PERT and CPM. (Sections 21.1 to 21.7)

**Non-linear programming:** Introduction, general non-linear programming problem (NLPP), constrained optimization, Kuhn-Tucker conditions, graphical solution, quadratic programming, Wolfe's modified simplex method. (Sections 24.1 to 24.5, 25.1 to 25.5)

### References

- [1] Thaha, H.A., Operations research – an introduction, Prentice-Hall.  
 [2] Mital, K.V. and Mohan, C., Operations research and system analysis, New age international Pvt. Ltd.

### Distribution of internal marks:

Attendance	: 3 marks
Assignments	: 6 marks
Tests/oral/seminar	: 6 marks

## PAPER VII - ELECTIVE B2 MATHEMATICAL MODELLING

This paper is divided into THREE units .

Unit	Teaching hours	Aggregate marks	Maximum marks
Unit I	40	30	20
Unit II	40	35	20
Unit III	40	30	20
<b>Total</b>	<b>120</b>	<b>95</b>	<b>60</b>

### UNIT I

Mathematical modelling – what and why? Types of modelling, its limitations. Identifying the essentials of a problem. Mathematical formulation and solution of formulated problems (problems – take motion of a pendulum, motion of a rain drop). Interpretation of the solution.

### UNIT II

Basic concepts like free fall of a body, upward motion under gravity, simple harmonic motion, projectile motion, Newton's law of gravitation, escape velocity, central forces. Modelling planetary motion, Kepler's laws. Limitations of the model.

Modelling Blood Flow problem and oxygen transfer in Red cells. Formulation solution, interpretation and limitations of the models.

### UNIT III

Understanding problem of investments, Markowitz model, Return variations, risk valuations diversification, Portfolio selection, feasible set, efficient and optimal portfolio, limitations of the model developed.

Basic definitions and fundamental concepts, simple epidemic model, general epidemic model, recurrent epidemic model without and with undamped waves. Formulation, solution, interpretation and limitations of the models.

### Text

### References

- [1] Bender, E.A., An introduction to mathematical modeling, Wiley (1978).  
 [2] Gibbons, M. M., A concrete approach to mathematical modeling, Addison Wesley (1989).  
 [3] Vera Press, Introduction to the theory of error-correcting codes.

### Distribution of internal marks:

Attendance : 3 marks  
 Assignments : 6 marks  
 Tests/oral/seminar : 6 marks

\*Text book and Model Question Paper of this elective will be intimated later

## PAPER VII - ELECTIVE B3 DISCRETE MATHEMATICS

This paper is divided into THREE units.

Unit	Topic	Teaching Hours	Aggregate Marks	Maximum Marks
Unit I	Graph theory	50	40	25
Unit II	Boolean Algebra and Logic	20	15	10
Unit III	Formal Languages and Automata	50	40	25
<b>Total</b>		<b>120</b>	<b>95</b>	<b>60</b>

### UNIT I – GRAPH THEORY

**Text:** John.C, and Holten, D.A., A first look at graph theory, Allied publishers (1991).

Definitions of graphs, graphs as models, more definitions, vertex degrees, subgraphs, paths and cycles, matrix representation of graphs, fusions.

Trees, bridges, spanning trees, connector problems, cut vertices and connectivity.

Euler tours, The Chinese postman problem, Hamiltonian graphs, the travelling salesman problem (algorithm deleted)

Matchings, augmenting path, the marriage problem, Hall's marriage problem, personal assignment problem (algorithm deleted), optimal assignment problems (algorithms deleted).

(Chapters 1,2,3,4. Section 2.5 is omitted. Exclude algorithms)

## UNIT II - BOOLEAN ALGEBRA AND LOGIC

**Text:** Lipchitz, Set theory, Schaum series.

**Boolean Algebra:** Definition, duality in Boolean Algebra, order in Boolean Algebra, switching circuit designs.

**Logic:** Algebra of propositions, statements, conjunction, disjunction, negation, conditional, bi-conditional, tautologies and contradictions, logical equivalence, logically true and logically equivalent statements, quantifiers, propositional functions and truth sets, universal quantifier, existential quantifier, negation of propositions which contain quantifier, counter examples, propositional functions containing more than one variable.

## UNIT III - FORMAL LANGUAGES AND AUTOMATA

**Text:** Ullman, J.D. and Hopcroft, Introduction to automata theory, languages and computation, Narosa.

Finite automata and regular expressions – properties of regular sets – context-free grammars – pushdown automata.  
(Chapters 2, 3, 4, 5)

### References

- [1] Bondy, J.A. and Murthy, Graph theory with applications, Mac Millan.
- [2] Wilson, R.J., Introduction to Graph theory.
- [3] Stoll, R.R., Set theory and logic, Errasia publishers, New Delhi.
- [4] Roson, K.H., Discrete mathematical structures.
- [5] Reverz, G.E., Introduction to formal language, Mc Graw Hill.

### Distribution of internal marks:

Attendance : 3 marks  
 Assignments : 6 marks  
 Tests/oral/seminar : 6 marks

## PAPER VIII - ELECTIVE C1 PRINCIPLES OF COMPUTER SCIENCE

This paper is divided into THREE units.

Unit	Teaching hours	Aggregate marks	Maximum marks
Unit I	30	25	15
Unit II	50	40	25
Unit III	40	30	20
<b>Total</b>	<b>120</b>	<b>95</b>	<b>60</b>

**Text:** Theory and problems of data structure, Schaum series, McGraw Hill publications.

### UNIT I

Data, its organization, fields, records, file, introduction to data structures, data structure operations – algorithms, examples, time-space trade-off, algorithmic notation – control structures – sequential logic, selection logic, iteration logic, complexity of algorithms – worst case & average case, Big O notation, sub algorithms, algorithms for solving various simple mathematical problems (such as average of ‘n’ numbers, prime number, etc).

Arrays – linear arrays, its representation – traversal, inserting, deleting, sorting – bubble sort, complexity of bubble sort, selection sort, insertion sort, searching – linear search, binary search – complexity of binary search. Multidimensional arrays – its representation – matrix operation algorithm – addition, multiplication, sparse matrix.

### UNIT II

Linked list – its representation, traversing, searching, memory allocation, garbage collection, insertion into linked list, insertion and deletion algorithms – two way list.

Stacks, definition – array representation of stacks – push() & pop(), application, arithmetic expressions – polish notation & reverse polish notation, conversion of infix expression to postfix, evaluation of postfix expression, recursion – factorial function – sum of  $n$  numbers function – Fibonacci function, quick sort.

### UNIT III

Queues – definition – representation of queues – insertion and deletion – deques – priority queues – application.

Trees – binary trees – terminology – complete, full binary trees – traversing binary trees-in order, preorder, post order, binary search trees – searching, complexity, deletion, general trees, graph and their application, traversal-bfs, dfs, shortest path algorithms.

### References

- [1] Horowitz and Sahni, Fundamentals of data structures, Galgotia publication.  
 [2] Data structure using C++, Prentice Hall of India, International edition (1986).

### Distribution of internal marks:

Attendance	: 3 marks
Assignments	: 6 marks
Tests/oral/seminar	: 6 marks

## PAPER VIII - ELECTIVE C2

### COMPUTER FUNDAMENTALS AND C LANGUAGE

This paper consists of **theory and practical**.

Theory part is divided into TWO units.

Unit	Teaching hours	Aggregate marks	Maximum marks
Unit I	30	25	15
Unit II	60	40	25
<b>Total</b>	<b>90</b>	<b>65</b>	<b>40</b>

**Text 1:** Balaguruswamy, E., ANSI C (3<sup>rd</sup> edition), Tata McGraw Hill.

**Text 2:** Sinha, P.K., Computer fundamentals, BPB publications.

## UNIT I

Characteristics of computers, evolution of computers, computer generation, simple model of computer, classification of computers. Positional number systems - binary, octal and hexa decimal, conversion from one system to another, BCD, EBCDIC, ASCII codes. Binary arithmetic's addition, subtraction, multiplication, division. Primary, secondary storage devices, RAM, ROM, PROM and EPROM, cache memory, floppy disk, winchester disk, magnetic tape, optical disk, input and output devices.

Developing a program, program design, algorithm, flow chart, coding, common programming errors, programming test and debugging, program efficiency. Importance of C, basic structure of C, programming style, executing a C program. Character set, C tokens, keyword and identifiers, constants, data type declaration of variables, assigning values to variables, defining symbolic constants. Arithmetic of operators, relational operators, assignment operator, increment and decrement operator, conditional operator, bitwise operator, special operator, arithmetic expressions, evaluation of expressions, precedence of arithmetic operators, type conversions in expressions, operator precedence and associativity.

## UNIT II

Managing input output operators: Reading a character, writing a character, formatted input and output. Decision making with IF statement, IF ELSE statement, nesting of IF ELSE statements, the ELSE ladder, the switch statement, the ?: operator, GO TO statements, decision making and looping, the while statement DO..WHILE statement, the FOR statement, jumps in loops. One dimensional arrays, two dimensional arrays, initializing two dimensional arrays, multidimensional arrays, declaration and initializing string variables, reading strings from terminal, writing string to screen, arithmetic operations on character, putting strings together, comparison of two strings, string handling functions. Functions: C functions, return values and types, calling a function, type of functions, nesting of functions, recursion, functions with arrays, scope and lifetime of variables in functions. Structure and union: Definition, giving values to members, initialization, array of structure array within structure, structure within structure, functions, union.

Pointers, accessing the address of a variable, declaration and initializing pointers, accessing a variable through its pointer, expression, pointer and arrays, pointer and character string, pointer and functions. File management: Defining and opening a file, closing a file, I/O operations on a file, error handling, random access to file, command line arguments. Dynamic memory allocation and linked lists – introduction, concepts of linked list, advantages of linked list, basic operations and applications of linked list. Preprocessor, macro, macro substitution, macros with arguments, nesting of macros, file inclusion, compiler control directives.

### References

- [1] Kanikar, Y., Let us C, BPB publication.
- [2] Programming in C, Schaum's series.
- [3] Ritchie, D., The 'C'.
- [4] Spirit of C.
- [5] Rajaraman, V., Fundamentals of computers, Prentice hall of India Pvt. Ltd.

**PRACTICAL** (30 hours) : Marks 25 (20 external , 5internal)

### List of practicals(Model)

Develop C language program to:

1. Solve quadratic equation.
2. Find largest and second largest among three numbers.
3. Find largest and smallest among N numbers.
4. Display prime numbers in a range.
5. Find prime factors of numbers.
6. Find GCM and LCM of two numbers.
7. Check: string is palindrome or not.

8. Factorial using pointer.
9. Sort numbers in ascending order.
10. Find value of sine series.
11. Find value of cosine series.
12. Concatenate two strings and find the number of vowels in the string.
13. Matrix addition and subtraction.
14. Matrix multiplication.
15. Display student's details using structure.
16. Convert decimal to binary, octal and hexadecimal.
17. Display employee details using structure.
18. Perform file read / write operation.

**Distribution of internal marks:**

<b>Theory</b>		<b>Practical</b>	
Attendance	: 2 marks	Attendance	: 1 marks
Assignments	: 4 marks	Tests	:2 marks
Tests/oral/seminar	: 4 marks	Record work	: 2 marks

**PAPER VIII - ELECTIVE C3  
PROGRAMMING WITH JAVA**

This paper consists of **theory and practical**.

Theory part is divided into TWO units as detailed below.

Unit	Teaching hours	Aggregate marks	Maximum marks
Unit I	45	30	20
Unit II	45	30	20
<b>Total</b>	<b>90</b>	<b>60</b>	<b>40</b>

**Text:** Balaguruswamy, E., Programming with Java.

**UNIT I**

Introduction to Java – Features of Java – Object oriented concept – Java and internet – Java Applet and application program – Building and running Java application – Java source code – Byte code – Java virtual machine – Structure of Java program.

Elements of Java language – constants, keywords, variables, data types – Java operators – Assignment, arithmetic, relational, logical, increment and decrement, bitwise, instance of, dot and conditional operators.

Control statements in Java – if statement – switch statement – looping statement – Exit and entry controlled loop – for loop, while loop, do...while loop – Continue and break statement – Labeled continue and break. Array and string handling functions.

**UNIT II**

Introduction to class and object – Creating and accessing object – Variable and methods – Method overloading – Constructors – Constructor overloading – Static variable and static methods.

Inheritance – Single inheritance – Multilevel inheritance – Sub class constructors – super method – Access controls – Private, protected and public – Overriding methods – Final class and methods – Abstract class and methods. Interface – Defining interface – Extending interface – Implementing interface – Dynamic method dispatch.

Exception handling – Type exception – Try catch statement, multiple catch statement, nested try statement, throws and finally statement – User defined exception – Package – Defining package – Importing package, CLASSPATH – Applet programming – Applet life cycle – APPLET Tag – simple Applet program.

### References

- [1] Naaughton, R.ans Schildt, H., Java 2 complete reference.  
 [2] Arnold, K. and Gosling, J., Java Programming.

**PRACTICAL** (30 hours) : Marks 25 (20 external , 5internal)

### List of practical (model)

1. Write a program to generate Fibonacci series.
2. Write a program to check whether given number is prime or not.
3. Write a program to find the roots of a quadratic equation.
4. Write a program to perform complex number operations.
5. Write a program to find the sum of sine series.
6. Write a program to display Armstrong numbers within a range.
7. Write a program to convert decimal number to binary number.
8. Write a program to sort an array.
9. Write a program to perform matrix operation.
10. Write a program to perform string manipulations.
11. Write a program to check whether string is palindrome or not.
12. Write a program to find factorial of given number using recursion.
13. Write a program to illustrate method of overloading.
14. Write a program to illustrate multiple inheritances.
15. Write a program to illustrate interface.
16. Write a program to illustrate dynamic method dispatch.
17. Write a program to illustrate Exception handling.
18. Write a program to create user defined exception.
19. Write a program to illustrate package.
20. Write a simple program using Applet.

### Distribution of internal marks:

<u>Theory</u>		<u>Practical</u>	
Attendance	: 2 marks	Attendance	: 1 marks
Assignments	: 4 marks	Tests	: 2 marks
Tests/oral/seminar	: 4 marks	Record work	: 2 marks

Sd/-  
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