# UNIVERSITY OF JAMMU
# SYLLABI FOR BACHELOR DEGREE PROGRAMME
# IN MATHEMATICS/APPLIED MATHEMATICS

The following Courses of Study are prescribed for 3rd to 6th semester of Bachelor Degree (UG) programme under CBCS in the subject of Mathematics/Applied Mathematics.

| Semester | Course No. | Title | Credits | Nature of Course |
|---|---|---|---|---|
| III | UMTTC301 | Real Analysis | 06 | Core |
| | UMTTS302 | Logic and Sets | 04 | Skill Enhancement |
| | UMTTS303 | Analytic Geometry | 04 | Skill Enhancement |
| | UMTTS304 | Integral Calculus | 04 | Skill Enhancement |
| IV | UMTTC401 | Algebra | 06 | Core |
| | UMTTS402 | Vector Calculus | 04 | Skill Enhancement |
| | UMTTS403 | Theory of Equations | 04 | Skill Enhancement |
| | UMTTS404 | Number Theory | 04 | Skill Enhancement |
| V* | UMTTE501 | Matrices | 06 | Discipline Specific Elective (DSE) |
| | UMTTE502 | Mechanics | 06 | DSE |
| | UMTTE503 | Linear Algebra | 06 | DSE |
| | UMTTS504 | Probability and Statistics | 04 | Skill Enhancement |
| | UMTTS505 | Portfolio Optimization | 04 | Skill Enhancement |
| | UMTTS506 | Mathematical Modeling | 04 | Skill Enhancement |
| VI** | UMTTE601 | Numerical Methods | 06 | DSE |
| | UMTTE602 | Complex Analysis | 06 | DSE |
| | UMTTE603 | Linear Programming | 06 | DSE |
| | UMTTS604 | Boolean Algebra | 04 | Skill Enhancement |
| | UMTTS605 | Transportation and Game Theory | 04 | Skill Enhancement |
| | UMTTS606 | Graph Theory | 04 | Skill Enhancement |

\* Each student shall opt for one Discipline Specific Elective course (DSE)  out of three Displine Specific Courses (DSE) in semester V.

\*\* Each student shall opt for one Discipline Specific Elective  course out of three Discipline Specific Elective courses in semester VI.

## Semester III

## Title of the Course/ Course Number: - Real Analysis/UMTTC301

Internal Assessment Test: 20 Marks                    Credits: 06

Duration:  2 ½

External End Semester University Examination: 80 Marks

( For the Examinations to be held in Dec 2017, 2018 and 2019 )

### UNIT-I

Finite and infinite sets, countable and uncountable sets, their examples and results, absolute value, triangle inequality and its applications, bounded and unbounded sets, suprema and infima, axiomatic definition of real number system as a complete ordered field, least upper bound and greatest upper bound properties of reals, the field of rational numbers is not complete, characterization of suprema and infima of sets, Archimedean property, existence of rationals and irrationals between reals, concept of cluster points and statement of Bolzano-Weierstrass theorem.

### UNIT-II

Real sequences and their boundedness, convergence and divergence, uniqueness of limit, algebra of limits, Cauchy convergence criterion, Cauchy's first and second theorem on limits, squeeze theorem, monotone convergence theorem, Nested-interval property of real numbers, exercises and problems based on these topics

### UNIT-III

Infinite series and their convergence and divergence, Cauchy's general principle of convergence, criterion for convergence of a series of positive terms, geometric series, p-series, comparison tests, D'Alembert's ratio test, Cauchy's root test, Raabe's test Gauss's test (without proof), problems and exercises based on these topics.

### UNIT-IV

Cauchy's condensation test and convergence of , alternating series, absolute and conditional convergence Leibnitz's test, problems and exercises based on these topics. Some theorems on continuity and uniform continuity viz. every continuous function attains its bounds on closed and bounded interval, intermediate value theorem, continuity implies uniform continuity on closed intervals, relations between continuity and uniform continuity.

### UNIT-V

Sequences and series of functions, pointwise and uniform convergence, $M_n$-test, M-test, statements of the results about uniform convergence and integrability and differentiability of functions, power series and radius of convergence, problems and exercise based on these concepts.

**Books Recommended:**
- T. M. Apostol, Calculus (Vol. I), John Wiley and Sons (Asia) P. Ltd., 2002.
- R.G. Bartle and D. R Sherbert, Introduction to Real Analysis, John Wiley and Sons (Asia) P. Ltd., 2000.
- S. C. Malik and S. Arora, Mathematical Analysis, New Age international Publishers, 2010.

**Note:-**

- The evaluation of a candidate shall be awarded and record thereof maintained in accordance with the regulations prescribed for the purpose under CBCS as per the following:

| Theory | Syllabus to be covered in the examination | Time allotted | % Weightage(Marks) |
|---|---|---|---|
| **Internal Assessment Test** The question paper will consist of two parts: Part A: Total weightage of this part is 10 marks. It will contain 08 short answer type questions selecting atleast three from each of the two/three units(50 % of the syllabus) covered. A candidate has to attempt any five and each question carries 02 marks. Part B: Total weightage of this part is 10 marks. It will contain 02 long answer type questions selecting one from each of the first two units/50 % of the syllabus. A candidate has to attempt any one question and it carries 10 marks. | Upto 50% (after 45 lectures) | **1** hour | 20% |
| **External end semester university examination** The question paper will contain 05 short answer type questions selecting one from each unit ( without details explanation) of 04 marks each(No choice all compulsory), 03 short answer type questions ( without details explanation) of 08 marks each(No choice all compulsory), 04 long answer type questions( with analysis/explanation or critical analysis/evaluation) selecting atmost one from each unit so as to cover the maximum units/topics in the syllabus. A candidate has to attempt any two questions carrying 18 marks each. | Upto 100% (90 lectures) | **2.5** hours | 80% |

- Each lecture will be of one hour duration.

**Title of the Course/ Course Number: - Logic and Sets/ UMTTS302**

Internal Assessment Test: 20 Marks                    Credits: 04

External End Semester University Examination: 80 Marks
( For the Examinations to be held in Dec 2017, 2018 and 2019 )

Introduction, propositions, truth table, negation, conjunction and disjunction. Implications, biconditional propositions, converse, contra positive and inverse propositions and precedence of logical operators. Propositional equivalence: Logical equivalences. Predicates and quantifiers: Introduction, Quantifiers, Binding variables and Negations.

Sets, subsets, Set operations, the laws of set theory and Venn diagrams. Examples of finite and infinite sets. Finite sets and counting principle. Empty set, properties of empty set. Standard set operations. Classes of sets. Power set of a set.

Difference and Symmetric difference of two sets. Set identities, Generalized union and intersections. Relation: Product set, Composition of relations, Types of relations, Partitions, Equivalence Relations with example of congruence modulo relation.

**Books Recommended**
- R.P. Grimaldi, Discrete Mathematics and Combinatorial Mathematics, Pearson Education, 1998.
- P.R. Halmos, Naive Set Theory, Springer, 1974.
- E. Kamke, Theory of Sets, Dover Publishers, 1950

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| Theory | Syllabus to be covered in the examination | Time allotted | % Weightage (Marks) |
|---|---|---|---|
| **Internal Assessment Test** The question paper will consist of two parts: <br> Part A:Total weightage of this part is 10 marks. It will contain 08 short answer type questions uniformly distributed in 50 % of the syllabus covered. A candidate has to attempt any five and each question carries 02 marks. <br> Part B: Total weightage of this part is 10 marks. It will contain 02 long answer type questions uniformly distributed in 50 % of the syllabus covered. A candidate has to attempt any one question and it carries 10 marks. | Upto 50% (after 45 lectures) | **1** hour | 20% |
| **External end semester university examination** The question paper will contain 05 short answer type questions ( without details explanation) of 04 marks each(No choice all compulsory), 03 short answer type questions ( without details explanation) of 08 marks each(No choice all compulsory), 04 long answer type questions( with analysis/explanation or critical | Upto 100% (90 lectures) | **2.5** hours | 80% |

| analysis/evaluation) uniformly distributed in whole of the syllabus so as to cover the maximum topics in the syllabus. A candidate has to attempt any two questions carrying 18 marks each. | | | |
|---|---|---|---|

- Each lecture will be of one hour duration.

## SKILL ENHANCEMENT COURSE
## III – SEMESTER

**Title of the Course/ Course Number: - Analytical Geometry / UMTTS303**

Internal Assessment Test: 20 Marks                              Credits: 04
External End Semester University Examination: 80 Marks
( For the Examinations to be held in Dec 2017, 2018 and 2019 )

Techniques for sketching parabola, ellipse and hyperbola. Reflection properties of parabola, ellipse and hyperbola. Classification of quadratic equations representing lines, parabola, ellipse and hyperbola. Spheres, Cylindrical surfaces. Illustrations of graphing standard quadric surfaces like cone, ellipsoid.

**Books Recommended**

- G.B. Thomas and R.L. Finney, Calculus, 9th Ed., Pearson Education, Delhi, 2005.
- H. Anton, I. Bivens and S. Davis, Calculus, John Wiley and Sons (Asia) Pvt. Ltd., 2002.
- S.L. Loney, The Elements of Coordinate Geometry, McMillan and Company, London.
- R.J.T. Bill, Elementary Treatise on Coordinate Geometry of Three Dimensions, McMillan India Ltd., 1994.

**Note:-**

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| Theory | Syllabus to be covered in the examination | Time allotted | % Weightage(Marks) |
|---|---|---|---|
| **Internal Assessment Test** The question paper will consist of two parts:<br>Part A: Total weightage of this part is 10 marks. It will contain 08 short answer type questions uniformly distributed in 50 % of the syllabus covered. A candidate has to attempt any five and each question carries 02 marks.<br>Part B: Total weightage of this part is 10 marks. It will contain 02 long answer type questions uniformly distributed in 50 % of the syllabus covered. A candidate has to attempt any one question and it carries 10 marks. | Upto 50% (after 45 lectures) | **1** hour | 20% |
| **External end semester university examination** The question paper will contain 05 short answer type questions ( without details explanation) of 04 marks each(No choice all compulsory), 03 short answer type | Upto 100% (90 lectures) | **2.5** hours | 80% |

| | | | |
|---|---|---|---|
| questions ( without details explanation) of 08 marks each(No choice all compulsory), 04 long answer type questions ( with analysis/explanation or critical analysis/evaluation) uniformly distributed in whole of the syllabus so as to cover the maximum topics in the syllabus. A candidate has to attempt any two questions carrying 18 marks each. | | | |

- Each lecture will be of one hour duration.

# SKILL ENHANCEMENT COURSE
## III - SEMESTER

### Title of the Course/ Course Number:- Integral Calculus / UMTTS304

Internal Assessment Test: 20 Marks                              Credits: 04

External End Semester University Examination: 80 Marks
( For the Examinations to be held in Dec 2017, 2018 and 2019 )

Integration by Partial fractions, integration of rational and irrational functions. Properties of definite integrals. Reduction formulae for integrals of rational, trigonometric, exponential and logarithmic functions and of their combinations.
Areas and lengths of curves in the plane, volumes and surfaces of solids of revolution. Double and Triple integrals.

**Books Recommended**

- G.B. Thomas and R.L. Finney, Calculus, 9th Ed., Pearson Education, Delhi, 2005.
- H. Anton, I. Bivens and S. Davis, Calculus, John Wiley and Sons (Asia) P. Ltd., 2002.

**Note:-**

- The evaluation of a candidate shall be awarded and record thereof maintained in accordance with the regulations prescribed for the purpose under CBCS as per the following:

| Theory | Syllabus to be covered in the examination | Time allotted | % Weightage(Marks) |
|---|---|---|---|
| **Internal Assessment Test** The question paper will consist of two parts: Part A: Total weightage of this part is 10 marks. It will contain 08 short answer type questions uniformly distributed in 50 % of the syllabus covered. A candidate has to attempt any five and each question carries 02 marks. Part B: Total weightage of this part is 10 marks. It will contain 02 long answer type questions uniformly distributed in 50 % of the syllabus covered. A candidate has to attempt any one question and it carries 10 marks. | Upto 50% (after 45 lectures) | **1** hour | 20% |

| | | | |
|---|---|---|---|
| **External end semester university examination** The question paper will contain 05 short answer type questions ( without details explanation) of 04 marks each(No choice all compulsory), 03 short answer type questions ( without details explanation) of 08 marks each(No choice all compulsory), 04 long answer type questions( with analysis/explanation or critical analysis/evaluation) uniformly distributed in whole of the syllabus so as to cover the maximum topics in the syllabus. A candidate has to attempt any two questions carrying 18 marks each. | Upto 100% (90 lectures) | **2.5** hours | 80% |

- Each lecture will be of one hour duration.

**Title of the Course/ Course Number: - Algebra/UMTTC401**
Internal Assessment Test: 20 Marks                 Credits: 06
External End Semester University Examination: 80 Marks
( For the Examinations to be held in May 2018, 2019 and 2020 )

## UNIT-I

Binary operations, semi-groups and groups with plenty of examples from number system, matrices, functions, groups of symmetries of triangle, square etc. Abelian and non-abelian groups, finite groups, definition of group based on left and right axioms, order of an element of a group and results based on order of an element, permutation groups, even and odd permutations, examples and exercises based on groups and semi-groups

## UNIT-II

Subgroups, their characterization, intersection, union and product of groups, subgroup generated by a subset, examples of subgroups including centre of a group, commutator subgroup of a group, characterization of an abelian group in terms of commutator subgroup (G is abelian iff the commutator subgroup of G is trivial), cyclic groups, their generators and properties, (i.e. counting principle for the number of elements in HK).

## UNIT-III

Cosets, their examples and properties, index of a subgroup, Langrange's theorem and its applications including Euler's theorem and Fermat's theorem, normal subgroups, their examples and characterization, quotient groups, results related to quotient groups like , is abelian or cyclic if G is so etc.

## UNIT-IV

Homomorphism and isomorphism of groups and their examples, kernel of a homomorphism, group of automorphisms, fundamental theorem of homomorphism including $2^{nd}$ and $3^{rd}$ laws of isomorphism, the set I(G) of all inner automorphisms is normal subgroup of A(G) the group of all automorphisms of group G and   where C(G) is the centre of G, transformation groups and Cayle's theorem, cyclic groups upto isomorphism, examples and exercises based on these concepts.

## UNIT-V

Concepts of rings, integral domains and fields with plenty of examples, subrings, ideals and results based on these concepts, quotient ring, ring homomorphism and isomorphism, fundamental theorem of ring homomorphism, prime ideals, maximal ideals and their characterization, examples and exercises based on these concepts.

**Books Recommended:**

- John B. Fraleigh, A First Course in Abstract Algebra, 7th Ed., Pearson, 2002.
- M. Artin, Abstract Algebra, 2nd Ed., Pearson, 2011.
- Joseph A Gallian, Contemporary Abstract Algebra, 4th Ed., Narosa, 1999.
- N.S. Gopalakrishnan, University Algebra, New Age International Publisher, 2009.

**Note:**

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| Theory | Syllabus to be covered in the examination | Time allotted | % Weightage(Marks) |
|---|---|---|---|
| **Internal Assessment Test**  The question paper will consist of two parts:<br>Part A: Total weightage of this part is 10 marks. It will contain 08 short answer type questions selecting atleast three from each of the two/three units(50 % of the syllabus) covered. A candidate has to attempt any five and each question carries 02 marks.<br>Part B: Total weightage of this part is 10 marks. It will contain 02 long answer type questions selecting one from each of the first two units/50 % of the syllabus. A candidate has to attempt any one question and it carries 10 marks. | Upto 50% (after 45 lectures) | **1** hour | 20% |
| **External end semester university examination**  The question paper will contain 05 short answer type questions selecting one from each unit ( without details explanation) of 04 marks each(No choice all compulsory), 03 short answer type questions ( without details explanation) of 08 marks each(No choice all compulsory), 04 long answer type questions( with analysis/explanation or critical analysis/evaluation) selecting atmost one from each unit so as to cover the maximum units/topics in the syllabus. A candidate has to attempt any two questions carrying 18 marks each. | Upto 100% (90 lectures) | **2.5** hours | 80% |

- Each lecture will be of one hour duration.

# SKILL ENHANCEMENT COURSE
## IV - SEMESTER
### Title of the Course/ Course Number: - Vector Calculus / UMTTS402
Internal Assessment Test: 20 Marks            Credits: 04
External End Semester University Examination: 80 Marks
( For the Examinations to be held in May 2018, 2019 and 2020 )

Differentiation and partial differentiation of a vector function. Derivative of sum, dot product and cross product of two vectors.

Gradient, divergence and curl.

**Books Recommended**

- G.B. Thomas and R.L. Finney, Calculus, 9th Ed., Pearson Education, Delhi, 2005.
- H. Anton, I. Bivens and S. Davis, Calculus, John Wiley and Sons (Asia) P. Ltd. 2002.
- P.C. Matthew's, Vector Calculus, Springer Verlag London Limited, 1998.

**Note:-**

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| Theory | Syllabus to be covered in the examination | Time allotted | % Weightage(Marks) |
|---|---|---|---|
| **Internal Assesment Test**  The question paper will consist of two parts: <br> Part A: Total weightage of this part is 10 marks. It will contain 08 short answer type questions uniformly distributed in  50 % of the syllabus covered. A candidate has to attempt any five and each question carries 02 marks. <br> Part B: Total weightage of this part is 10 marks. It will contain 02 long answer type questions uniformly distributed in  50 % of the syllabus covered. A candidate has to attempt any one question and it carries 10 marks. | Upto 50% (after 45 lectures) | **1 hour** | 20% |
| **External end semester university examination** The question paper will contain 05 short answer type questions ( without details explanation) of 04 marks each(No choice all compulsory), 03 short answer type questions ( without details explanation) of 08 marks each(No choice all compulsory), 04 long answer type questions( with analysis/explanation or critical analysis/evaluation) uniformly distributed in whole of the syllabus so as to cover the maximum topics in the syllabus. A candidate has to attempt any two questions carrying 18 marks each. | Upto 100% (90 lectures) | **2.5 hours** | 80% |

- Each lecture will be of one hour duration.

**Title of the Course/ Course Number: - Theory of Equations / UMTTS403**
Internal Assessment Test: 20 Marks            Credits: 04
External End Semester University Examination: 80 Mark
( For the Examinations to be held in May 2018, 2019 and 2020 )


General properties of polynomials, Graphical representation of a polynomials, maximum and minimum values of a polynomials, General properties of equations, Descarte's rule of signs positive and negative rule, Relation between the roots and the coefficients of equations.

Symmetric functions, Applications symmetric function of the roots, Transformation of equations. Solutions of reciprocal and binomial equations. Algebraic solutions of the cubic and biquadratic. Properties of the derived functions.

**Books Recommended**

- W.S. Burnside and A.W. Panton, The Theory of Equations, Dublin University Press, 1954.
- C. C. MacDuffee, Theory of Equations, John Wiley & Sons Inc., 1954.

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| Theory | Syllabus to be covered in the examination | Time allotted | % Weightage(Marks) |
|---|---|---|---|
| **Internal Assesment Test** The question paper will consist of two parts:<br>Part A: Total weightage of this part is 10 marks. It will contain 08 short answer type questions uniformly distributed in 50 % of the syllabus covered. A candidate has to attempt any five and each question carries 02 marks.<br>Part B: Total weightage of this part is 10 marks. It will contain 02 long answer type questions uniformly distributed in 50 % of the syllabus covered. A candidate has to attempt any one question and it carries 10 marks. | Upto 50% (after 45 lectures) | **1** hour | 20% |
| **External end semester university examination** The question paper will contain 05 short answer type questions ( without details explanation) of 04 marks each(No choice all compulsory), 03 short answer type questions ( without details explanation) of 08 marks each(No choice all compulsory), 04 long answer type questions( with analysis/explanation or critical analysis/evaluation) uniformly distributed in whole of the syllabus so as | Upto 100% (90 lectures) | **2.5** hours | 80% |

| to cover the maximum topics in the syllabus. A candidate has to attempt any two questions carrying 18 marks each. | | | |
|---|---|---|---|

- Each lecture will be of one hour duration

## SKILL ENHANCEMENT COURSE
## IV - SEMESTER
### Title of the Course/ Course Number:- Number Theory/ UMTTS404
Internal Assessment Test: 20 Marks        Credits: 04
External End Semester University Examination: 80 Marks
( For the Examinations to be held in May 2018, 2019 and 2020 )

Division algorithm, Lame's theorem, linear Diophantine equation, fundamental theorem of arithmetic, prime counting function, statement of prime number theorem, Goldbach conjecture, binary and decimal representation of integers, linear congruences, complete set of residues.

Number theoretic functions, sum and number of divisors, totally multiplicative functions, definition and properties of the Dirichlet product, the Möbius inversion formula, the greatest integer function, Euler's phi-function.

**Books Recommended**

- David M. Burton, Elementary Number Theory 6th Ed., Tata McGraw-Hill Edition, Indian reprint, 2007.
- Richard E. Klima, Neil Sigmon, Ernest Stitzinger, Applications of Abstract Algebra with Maple, CRC Press, Boca Raton, 2000.
- Neville Robinns, Beginning Number Theory, 2nd Ed., Narosa Publishing House Pvt. Limited, Delhi, 2007.

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|---|---|---|---|
| **Internal Assessment Test** The question paper will consist of two parts: Part A: Total weightage of this part is 10 marks. It will contain 08 short answer type questions uniformly distributed in 50 % of the syllabus covered. A candidate has to attempt any five and each question carries 02 marks. Part B: Total weightage of this part is 10 marks. It will contain 02 long answer type questions uniformly distributed in 50 % of the syllabus covered. A candidate has to attempt any one question and it carries 10 marks. | Upto 50% (after 45 lectures) | **1** hour | 20% |
| **External end semester university examination** The question paper will contain 05 short answer type questions ( without details explanation) of 04 marks each(No choice all compulsory), 03 short answer type questions ( without | Upto 100% (90 lectures) | **2.5** hours | 80% |

| | | | |
|---|---|---|---|
| details explanation) of 08 marks each(No choice all compulsory), 04 long answer type questions( with analysis/explanation or critical analysis/evaluation) uniformly distributed in whole of the syllabus so as to cover the maximum topics in the syllabus. A candidate has to attempt any two questions carrying 18 marks each. | | | |

- Each lecture will be of one hour duration.

# DISCIPLINE SPECIFIC ELECTIVE

## Semester V

### Title of the Course/ Course Number:- Matrices / UMTTE501

Internal Assessment Test: 20 Marks                    Credits: 06

External End Semester University Examination: 80 Marks

( For the Examinations to be held in Dec 2018, 2019 and 2020 )

### UNIT-I

Matrices: Symmetric, Skew- Symmetric, Hermitian, Skew- Hermitian, Unitary and Orthogonal. Rank of a matrix, characteristic polynomial of a matrix, eigen values, eigen vectors. Cayley – Hamilton theorem and its applications to find inverse of a matrix. Exercises and examples based on these concepts.

### UNIT-II

(R), n=1,2,3 as a vector space. Concept of linear dependence and independence.Subspaces, different basis and dimension of these vector spaces. Exercises and results based on these concepts.

### UNIT-III

The columns of a matrix A are linearly independent iff there exists vector X$\neq$ 0 such that AX=0. The columns of a matrix A of order m×n are linearly independent iff rank of A is less than n. A matrix A has rank r iff it has r linearly independent columns, whereas any s columns, s>r are linearly dependent. Analogous results for rows. Linear, homogenous and non-homogenous equations. The equation AX=0 has non zero solution iff the rank of A is less than n, the number of columns. The number of linearly independent solutions of the equation AX=0 is n-r, where r is the rank of matrix A of order m×n. The equation AX=B is consistent iff the two matrices A and [A:B] are of the same rank.

### UNIT-IV

Translation, dialation , rotation , reflection in a point, line and plane. Matrix form of basic geometric transformations. Interpretation of eigen values and eigen vectors for such transformations and eigen spaces as invariant subspaces.

### UNIT-V

Diagonal fom of matrices, reduction to diagonal form upto matrices of order 3.Solution of system of linear equations using matrices.Illustrative examples of these concepts from staistics.

**Books Recommended:**

- A.I. Kostrikin, Introduction to Algebra, Springer Verlag, 1984.

- S.H. Friedberg, A.L. Insel and L.E. Spence,  Linear Algebra, Prentice Hall, New Delhi 2004.

- Richard Bronson, Theory and Problems of Matrix Operations, Tata McGraw Hill, 1989.

- Shanti Narayan, P.K.Mittal , A TextBook of Matrices, S.Chand& Co. Ltd. 2004.

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| Theory | Syllabus to be covered in the examination | Time allotted | % Weightage(Marks) |
|---|---|---|---|
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| **External end semester university examination**  The question paper will contain 05 short answer type questions selecting one from each unit ( without details explanation) of 04 marks each(No choice all compulsory), 03 short answer type questions ( without details explanation) of 08 marks each(No choice all compulsory), 04 long answer type questions( with analysis/explanation or critical analysis/evaluation) selecting atmost one from each unit so as to cover the maximum units/topics in the syllabus. A candidate has to attempt any two questions carrying 18 marks each. | Upto 100% (90 lectures) | **2.5** hours | 80% |

- Each lecture will be of one hour duration.

**Semester V**

**Title of the Course/ Course Number:- Mechanics / UMTTE502**

Internal Assessment Test: 20 Marks                    Credits: 06

External End Semester University Examination: 80 Marks

( For the Examinations to be held in Dec 2018, 2019 and 2020 )

### UNIT-I

Composition and resolution of forces, resultant of several concurrent forces, equilibrium of concurrent forces. Triangle law and polygon law of forces, Lami's theorem. Resultant of like and unlike parallel forces. Moment of forces about a point, Varigon's theorem. Examples and exercises based on these topics.

### UNIT-II

Rectilinear motion of particles, uniform rectilinear motion, uniformly accelerated rectilinear motion, curvilinear motion of a particle, rectangular components of velocity and acceleration. Tagential and normal components. Examples and exercises based on these topics.

### UNIT-III

Motion of a particle projected vertically upwards with a given velocity. Motion of projectile and its trajectory. Simple Harmonic Motion. The Simple Harmonic Oscillator: amplitude, period, frequency and energy. Simple problems based on these topics.

### UNIT-IV

Centre of gravity and Moment of inertia: concept of centre of gravity and centroid. Position of centroid, theorem of parallel and perpendicular axes. Moment of inertia of simple geometrical figures. Simple problems based on these topics.

### UNIT-V

Kinetics: work, power, kinetic energy, conservative force fields, conservation of energy, impulse, torque, conservation of linear and angular momentum. Non-conservative forces. Examples and exercises based on these topics.

**Books Recommended:-**

- A. S. Ramsay, Statics, C B S Publishers and Distributors (Indian Reprint), 1998.

- Murray R. Spiegel, Theoritical Mechanics, Schaum's outline series, Mc Graw Hill Book company.

**Note:**

- The evaluation of a candidate shall be awarded and record thereof maintained in accordance with the regulations prescribed for the purpose under CBCS as per the following:

| Theory | Syllabus to be covered in the examination | Time allotted | % Weightage(Marks) |
|---|---|---|---|
| **Internal Assesment Test**  The question paper will consist of two parts:<br>Part A: Total weightage of this part is 10 marks. It will contain 08 short answer type questions selecting atleast three from each of the two/three units(50 % of the syllabus) covered. A candidate has to attempt any five and each question carries 02 marks.<br>Part B: Total weightage of this part is 10 marks. It will contain 02 long answer type questions selecting one from each of the first two units/50 % of the syllabus. A candidate has to attempt any one question and it carries 10 marks. | Upto 50% (after 45 lectures) | **1** hour | 20% |
| **External end semester university examination**  The question paper will contain 05 short answer type questions selecting one from each unit ( without details explanation) of 04 marks each(No choice all compulsory), 03 short answer type questions ( without details explanation) of 08 marks each(No choice all compulsory), 04 long answer type questions( with analysis/explanation or critical analysis/evaluation) selecting atmost one from each unit so as to cover the maximum units/topics in the | Upto 100% (90 lectures) | **2.5** hours | 80% |

| syllabus. A candidate has to attempt any two questions carrying 18 marks each. | | | |
|---|---|---|---|

- Each lecture will be of one hour duration.

**DISCIPLINE SPECIFIC ELECTIVE**

**Semester V**

**Title of the Course/ Course Number:- Linear Algebra / UMTTE503**

Internal Assessment Test: 20 Marks                    Credits: 06

External End Semester University Examination: 80 Marks

( For the Examinations to be held in Dec 2018, 2019 and 2020 )

**UNIT-I**

Definition and examples of vector spaces, subspaces of a vector space and quotient space.Linear combination of vectors, linear span, linear dependence and linear independence of vectors. Exercises and results based on these concepts.

**UNIT-II**

Basis and dimension, Finite dimensional vector space, Existence theorem, Extension theorem, Dimension theorem, Homomorphism and Isomorphism of vector spaces. Fundamental theorem of Homomorphism. Exercises and problems based on these concepts.

**UNIT-III**

Dual spaces of a finite dimensional vector space – Definitions and examples.Basis and dimension of Dual space.Double dual of a vector space.Isomorphism between vector spaces and their double dual.

**UNIT-IV**

Linear transformation on vector space and their examples, algebra of linear transformation on a vector space, Null space and range of linear transformation . Rank - Nullity theorem. Inverse of a linear transformation on finite dimensional vector space.Matrix representation of linear transformation.Exercises and examples based on these concepts.

**UNIT-V**

Matrices: Symmetric, Skew- Symmetric, Hermitian, Skew- Hermitian, Unitary and Orthogonal. Rank of a matrix, characteristic polynomial of a matrix, eigen values, eigen vectors. Cayley – Hamilton theorem and its applications. Exercises and examples based on these concepts.

**Books Recommended:**

- K. Hoffman and R. Kunze, Linear Algebra, Prentice Hall of India, 1971.

- S. Lang, Introduction to Linear Algebra, $2^{nd}$ Ed., Springr, 2005.

- Gilbert Strang, Linear Algebra and its Applications, Thomsons, 2007.

**Note:**

- The evaluation of a candidate shall be awarded and record thereof maintained in accordance with the regulations prescribed for the purpose under CBCS as per the following:

| Theory | Syllabus to be covered in the examination | Time allotted | % Weightage(Marks) |
|---|---|---|---|
| **Internal Assesment Test**  The question paper will consist of two parts:<br>Part A: Total weightage of this part is 10 marks. It will contain 08 short answer type questions selecting atleast three from each of the two/three units(50 % of the syllabus) covered. A candidate has to attempt any five and each question carries 02 marks.<br>Part B: Total weightage of this part is 10 marks. It will contain 02 long answer type questions selecting one from each of the first two units/50 % of the syllabus. A candidate has to attempt any one question and it carries 10 marks. | Upto 50% (after 45 lectures) | **1** hour | 20% |
| **External end semester university examination**  The question paper will contain 05 short answer type questions selecting one from each unit ( without details explanation) of 04 marks each(No choice all compulsory), 03 short answer type questions ( without details explanation) of 08 marks each(No choice all compulsory), 04 long answer type questions( with analysis/explanation or critical analysis/evaluation) selecting atmost one from each unit so as to cover the maximum units/topics in the syllabus. A candidate has to attempt any two questions carrying 18 marks each. | Upto 100% (90 lectures) | **2.5** hours | 80% |

- Each lecture will be of one hour duration

**Title of the Course/ Course Number:- Probability and Statistics / UMTTS504**
Internal Assessment Test: 20                                Marks Credits: 04
External End Semester University Examination: 80 Marks
( For the Examinations to be held in Dec 2018, 2019 and 2020 )

Sample space, probability axioms, real random variables (discrete and continuous), cumulative distribution function, probability mass/density functions, mathematical expectation, moments, moment generating function, characteristic function, discrete distributions: uniform, binomial, Poisson, continuous distributions: uniform, normal, exponential.
Joint cumulative distribution function and its properties, joint probability density functions, marginal and conditional distributions, expectation of function of two random variables, conditional expectations, independent random variables.

**Books Recommended**

- Robert V. Hogg, Joseph W. McKean and Allen T. Craig, Introduction to Mathematical Statistics, Pearson Education, Asia, 2007.
- Irwin Miller and Marylees Miller, John E. Freund, Mathematical Statistics with Application, 7th Ed., Pearson Education, Asia, 2006.
- Sheldon Ross, Introduction to Probability Model, 9th Ed., Academic Press, Indian Reprint, 2007.

**Note:-**

- The evaluation of a candidate shall be awarded and record thereof maintained in accordance with the regulations prescribed for the purpose under CBCS as per the following:

| Theory | Syllabus to be covered in the examination | Time allotted | % Weightage(Marks) |
|---|---|---|---|
| **Internal Assesment Test**  The question paper will consist of two parts:<br>Part A: Total weightage of this part is 10 marks. It will contain 08 short answer type questions uniformly distributed in  50 % of the syllabus covered. A candidate has to attempt any five and each question carries 02 marks.<br>Part B: Total weightage of this part is 10 marks. It will contain 02 long answer type questions uniformly distributed in  50 % of the syllabus covered. A candidate has to attempt any one question and it carries 10 marks. | Upto 50% (after 45 lectures) | **1** hour | 20% |
| **External end semester university examination**  The question paper will contain 05 short answer type questions ( without details explanation) of 04 marks each(No choice all compulsory), 03 short answer type questions ( without details explanation) of 08 marks each(No choice all compulsory), 04 long answer type questions( with analysis/explanation or critical analysis/evaluation) uniformly distributed in whole of the syllabus so as to | Upto 100% (90 lectures) | **2.5** hours | 80% |

| | | | |
|---|---|---|---|
| cover the maximum topics in the syllabus. A candidate has to attempt any two questions carrying 18 marks each. | | | |

- Each lecture will be of one hour duration.

<u>**Skill Enhancement Course**</u>
<u>**Semester V**</u>

**Title of the Course/ Course Number:- Portfolio Optimization / UMTTS505**
Internal Assessment Test: 20                                     Marks Credits: 04
External End Semester University Examination: 80 Marks
( For the Examinations to be held in Dec 2018, 2019 and 2020)

Financial markets. Investment objectives. Measures of return and risk. Types of risks. Portfolio of assets. Expected risk and return of portfolio. Diversification. Mean-variance portfolio optimization- the Markowitz model and the two-fund theorem, risk-free assets and one fund theorem, efficient frontier. Portfolio performance evaluation measures.

**Books Recommended**

- F.K. Reilly, Keith C. Brown, Investment Analysis and Portfolio Management, 10th Ed., South-Western Publishers, 2011.
- H.M. Markowitz, Mean-Variance Analysis in Portfolio Choice and Capital Markets, Blackwell, New York, 1987.
- D.G. Luenberger, Investment Science, 2nd Ed., Oxford University Press, 2013.

**Note:-**

- The evaluation of a candidate shall be awarded and record thereof maintained in accordance with the regulations prescribed for the purpose under CBCS as per the following:

| Theory | Syllabus to be covered in the examination | Time allotted | % Weightage(Marks) |
|---|---|---|---|
| **Internal Assessment Test** The question paper will consist of two parts:<br>Part A: Total weightage of this part is 10 marks. It will contain 08 short answer type questions uniformly distributed in 50 % of the syllabus covered. A candidate has to attempt any five and each question carries 02 marks.<br>Part B: Total weightage of this part is 10 marks. It will contain 02 long answer type questions uniformly distributed in 50 % of the syllabus covered. A candidate has to attempt any one question and it carries 10 marks. | Upto 50% (after 45 lectures) | **1** hour | 20% |
| **External end semester university examination** The question paper will contain 05 short answer type questions ( without details explanation) of 04 marks each(No choice all compulsory), 03 short answer type questions ( without details explanation) of 08 marks each(No choice all compulsory), 04 long answer type questions( with analysis/explanation or critical | Upto 100% (90 lectures) | **2.5** hours | 80% |

analysis/evaluation) uniformly distributed in whole of the syllabus so as to cover the maximum topics in the syllabus. A candidate has to attempt any two questions carrying 18 marks each.

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- Each lecture will be of one hour duration.

## Skill Enhancement Course
## Semester V

### Title of the Course/ Course Number:- Mathematical Modeling / UMTTS506

Internal Assessment Test: 20 Marks                                        Credits: 04

External End Semester University Examination: 80 Marks

( For the Examinations to be held in Dec 2018, 2019 and 2020 )

Applications of differential equations: the vibrations of a mass on a spring, mixture problem, free damped motion, forced motion, resonance phenomena, electric circuit problem, mechanics of simultaneous differential equations.

Applications to Traffic Flow. Vibrating string, vibrating membrane, conduction of heat in solids, gravitational potential, conservation laws.

**Books Recommended**

- Shepley L. Ross, Differential Equations, 3rd Ed., John Wiley and Sons, 1984.
- I. Sneddon, Elements of Partial Differential Equations, McGraw-Hill, International Edition, 1967.

**Note:-**

- The evaluation of a candidate shall be awarded and record thereof maintained in accordance with the regulations prescribed for the purpose under CBCS as per the following:

| Theory | Syllabus to be covered in the examination | Time allotted | % Weightage(Marks) |
|---|---|---|---|
| **Internal Assessment Test** The question paper will consist of two parts: Part A: Total weightage of this part is 10 marks. It will contain 08 short answer type questions uniformly distributed in 50 % of the syllabus covered. A candidate has to attempt any five and each question carries 02 marks. Part B: Total weightage of this part is 10 marks. It will contain 02 long answer type questions uniformly distributed in 50 % of the syllabus covered. A candidate has to attempt any one question and it carries 10 marks. | Upto 50% (after 45 lectures) | **1** hour | 20% |
| **External end semester university examination** The question paper will contain 05 short answer type questions ( without details explanation) of 04 | Upto 100% (90 lectures) | **2.5** hours | 80% |

| marks each(No choice all compulsory), 03 short answer type questions ( without details explanation) of 08 marks each(No choice all compulsory), 04 long answer type questions( with analysis/explanation or critical analysis/evaluation) uniformly distributed in whole of the syllabus so as to cover the maximum topics in the syllabus. A candidate has to attempt any two questions carrying 18 marks each. | | | |
|---|---|---|---|

- Each lecture will be of one hour duration.

# DISCIPLINE SPECIFIC ELECTIVE

## Semester VI

### Title of the Course/ Course Number:- Numerical methods / UMTTE601

Internal Assessment Test: 20 Marks                    Credits: 06

External End Semester University Examination: 80 Marks

( For the Examinations to be held in May 2019, 2020 and 2021 )

### UNIT-I

Finite Differences, the operators $\Delta$, $\blacktriangledown$, $E$, $D$ and relation between them, separation of symbols. Interpolation ,Newton,s formula for Forward and Backward Interpolation, Lagrange's interpolation formula. Problems and exercises based on these topics.

### UNIT-II

Central Differences, Gauss Forward and Backward Interpolation formula. Sterling's formula, Bessel's formula.
Numerical differentiation, forward , backward and central differences formulae for numerical differentiation. Problems and exercises based on these concepts.

### UNIT-III

Numerical Integration, Newton-Cotes Quadrature formula, Trapezodial rule, Simpson's ⅓ and ⅜ rule, Boole's rule , Weddle,s rule , Euler- Maclaurin's formula.Problems and exercises based on these concepts.

### UNIT-IV

Algorithms, Convergence, Bisection method, Point iteration method, False position method, Secant method and Newton's method.

### UNIT-V

Solution of simultaneous algebraic equations, Gauss elimination method, Gauss-Jordan method, Iterative methods: Jacobi method, Gauss-Siedel method. Problems and exercises based on these concepts.

#### Books Recommended:

- B. Braide, A Friendly Introduction to Numerical Analysis, Pearson Education, India, 2007.

- S.S. Sastry, Introductory methods of Numerical Analysis, Prentice Hall of India, Private Limited, 2005.

- B.S. Grewal, Numerical Methods in Engineering and Science, KhannaPublishers , 2010.

**Note:**

- The evaluation of a candidate shall be awarded and record thereof maintained in accordance with the regulations prescribed for the purpose under CBCS as per the following:

| Theory | Syllabus to be covered in the examination | Time allotted | % Weightage(Marks) |
|---|---|---|---|
| **Internal Assessment Test** The question paper will consist of two parts: Part A: Total weightage of this part is 10 marks. It will contain 08 short answer type questions selecting atleast three from each of the two/three units(50 % of the syllabus) covered. A candidate has to attempt any five and each question carries 02 marks. Part B: Total weightage of this part is 10 marks. It will contain 02 long answer type questions selecting one from each of the first two units/50 % of the syllabus. A candidate has to attempt any one question and it carries 10 marks. | Upto 50% (after 45 lectures) | **1** hour | 20% |
| **External end semester university examination** The question paper will contain 05 short answer type questions selecting one from each unit ( without details explanation) of 04 marks each(No choice all compulsory), 03 short answer type questions ( without details explanation) of 08 marks each(No choice all compulsory), 04 long answer type questions( with analysis/explanation or critical analysis/evaluation) selecting atmost one from each unit so as to cover the maximum units/topics in the syllabus. A candidate has to attempt any two questions carrying 18 marks each. | Upto 100% (90 lectures) | **2.5** hours | 80% |

- Each lecture will be of one hour duration.

**DISCIPLINE SPECIFIC ELECTIVE**

**<u>Semester VI</u>**

**Title of the Course/ Course Number:- Complex Analysis / UMTTE602**

Internal Assessment Test: 20 Marks                                    Credits: 06

External End Semester University Examination: 80 Marks

( For the Examinations to be held in May 2019, 2020 and 2021 )

### UNIT-I

The complex plane, properties of complex numbers, polar representation , De- Moivre's theorem and its applications in finding the roots of complex numbers and in expressing powers of sine and cosine in terms of series of sine or cosine of multiples of $\theta$ and vice-versa.

### UNIT-II

Functions of complex variables, exponential function, Logarithmic functions.
Circular and hyperbolic functions of complex variables, relation between them and their properties.
Summation of series of circular functions.
Plenty of examples and exercises based on these concepts

### UNIT-III

Limits , Limits involving the point at infinity , continuity, regions in the complex plane , mapping and differentiability. Cauchy Riemann equations, sufficient condition for diffrentiability.

### UNIT-IV

Analytic functions, examples of analytic function.Definite integral of functions.Contours, Contour integral and its examples.Maximum Modulus Principle.Cauchy-Goursat theorem, Cauchy Integral Formula.

### UNIT-V

Liouville's  theorem and the fundamental theorem of algebra. Convergence of sequences and series, Taylor Series.Absolute and uniform convergence of power series.

**Books Recommended:**

•   Theodore  W. Gamelin, Complex Analysis,Springer, Berlin , Heidelberg, New York, 2001

- S. Ponnusamy, Foundations of Complex Analysis, 2nd **ed.**, Narosa Publishing House, India, 2005.

- Conway, J.B., Functions of One Complex Variable, 2nd **edition**, Springer, Berlin , Heidelberg, New York, 1978.

**Note:**

- The evaluation of a candidate shall be awarded and record thereof maintained in accordance with the regulations prescribed for the purpose under CBCS as per the following:

| Theory | Syllabus to be covered in the examination | Time allotted | % Weightage(Marks) |
|---|---|---|---|
| **Internal Assessment Test** The question paper will consist of two parts: Part A: Total weightage of this part is 10 marks. It will contain 08 short answer type questions selecting atleast three from each of the two/three units(50 % of the syllabus) covered. A candidate has to attempt any five and each question carries 02 marks. Part B: Total weightage of this part is 10 marks. It will contain 02 long answer type questions selecting one from each of the first two units/50 % of the syllabus. A candidate has to attempt any one question and it carries 10 marks. | Upto 50% (after 45 lectures) | **1** hour | 20% |
| **External end semester university examination** The question paper will contain 05 short answer type questions selecting one from each unit ( without details explanation) of 04 marks each(No choice all compulsory), 03 short answer type questions ( without details explanation) of 08 marks each(No choice all compulsory), 04 long answer type questions( with analysis/explanation or critical analysis/evaluation) selecting atmost one from each unit so as to cover the maximum units/topics in the syllabus. A candidate has to attempt any two questions carrying 18 marks each. | Upto 100% (90 lectures) | **2.5** hours | 80% |

- Each lecture will be of one hour duration.

# DISCIPLINE SPECIFIC ELECTIVE

## Semester VI

### Title of the Course/ Course Number:- Linear Programming / UMTTE603

Internal Assessment Test: 20 Marks                                    Credits: 06

External End Semester University Examination: 80 Marks

( For the Examinations to be held in May 2019, 2020 and 2021 )

### UNIT-I

Linear Programming problems, formulation of LPP, solution of Linear Programming problem by graphical methods: Corner Point method, Iso-Profit or Iso-Cost methods and Analytic method. Simple applications of these methods in industries.

### UNIT-II

Canonical and Standard forms of LPP. Convex sets, supporting and separating hyperplanes. Theory of Simplex method. Optimality and unboundedness.Fundamental theorem of Linear Programming problem. Examples and exercises based on these topics.

### UNIT-III

Duality, formulation of Dual Problem. Duality Principle, Dual simplex method, prima-dual relationships, transportation problem, Degeneracy in transportation problems. Some examples and exercises based on these concepts.

### UNIT-IV

Sensitivity Analysis, variation in the price vector, variation in the requirement vector, variation in the (i,j)th element of the coefficient matrix. Addition of new variable and constraint to the problem. Examples and exercises on these topics.

### UNIT-V

Integer Programming, solution of IPP, Gomory's all I.P. method, Construction of Gomory's constraint and Gomory's cutting plane, All integer and mixed integer cutting plane algorithm. Branch and Bound algorithm. Examples and exercises based on these topics.

Books Recommended:-

- Mokhtar S. Bazara, John J. Jarvis and Hanif D. Sherali, Linear Programming and Network flows, 2$^{nd}$ Ed. , John Wiley and Sons, India, 2004.

- Hamdy A. Taha, Operations Research, An Introduction, 8$^{th}$ Ed, Prentice-Hall India, 2006.

**Note:**

- The evaluation of a candidate shall be awarded and record thereof maintained in accordance with the regulations prescribed for the purpose under CBCS as per the following:

| Theory | Syllabus to be covered in the examination | Time allotted | % Weightage(Marks) |
|---|---|---|---|
| **Internal Assessment Test** The question paper will consist of two parts:<br>Part A: Total weightage of this part is 10 marks. It will contain 08 short answer type questions selecting atleast three from each of the two/three units(50 % of the syllabus) covered. A candidate has to attempt any five and each question carries 02 marks.<br>Part B: Total weightage of this part is 10 marks. It will contain 02 long answer type questions selecting one from each of the first two units/50 % of the syllabus. A candidate has to attempt any one question and it carries 10 marks. | Upto 50% (after 45 lectures) | **1** hour | 20% |
| **External end semester university examination** The question paper will contain 05 short answer type questions selecting one from each unit ( without details explanation) of 04 marks each(No choice all compulsory), 03 short answer type questions ( without details explanation) of 08 marks each(No choice all compulsory), 04 long answer type questions( with analysis/explanation or critical analysis/evaluation) selecting atmost one from each unit so as to cover the maximum units/topics in the syllabus. A candidate has to attempt any two questions carrying 18 marks each. | Upto 100% (90 lectures) | **2.5** hours | 80% |

- Each lecture will be of one hour duration.

# SKILL ENHANCEMENT COURSE

## Semester VI

### Title of the Course/ Course Number:- Boolean Algebra / UMTTS604

Internal Assessment Test: 20 Marks                               Credits: 04

External End Semester University Examination: 80 Marks

( For the Examinations to be held in May 2019, 2020 and 2020 )

Definition, examples and basic properties of ordered sets, maps between ordered sets, duality principle, maximal and minimal elements, lattices as ordered sets, complete lattices, lattices as algebraic structures, sublattices, products and homomorphisms.

Definition, examples and properties of modular and distributive lattices, Boolean algebras, Boolean polynomials, minimal forms of Boolean polynomials, Quinn-McCluskey method, Karnaugh diagrams, switching circuits and applications of switching circuits.

### Books Recommended

- B A. Davey and H. A. Priestley, Introduction to Lattices and Order, Cambridge University Press, Cambridge, 1990.
- Rudolf Lidl and Günter Pilz, Applied Abstract Algebra, 2nd Ed., Undergraduate Texts in Mathematics, Springer (SIE), Indian reprint, 2004.

**Note:-**

- The evaluation of a candidate shall be awarded and record thereof maintained in accordance with the regulations prescribed for the purpose under CBCS as per the following:

| Theory | Syllabus to be covered in the examination | Time allotted | % Weightage(Marks) |
|---|---|---|---|
| **Internal Assessment Test** The question paper will consist of two parts: Part A: Total weightage of this part is 10 marks. It will contain 08 short answer type questions uniformly distributed in 50 % of the syllabus covered. A candidate has to attempt any five and each question carries 02 marks. Part B: Total weightage of this part is 10 marks. It will contain 02 long answer type questions uniformly distributed in 50 % of the syllabus covered. A candidate has to attempt any one question and it carries 10 marks. | Upto 50% (after 45 lectures) | **1** hour | 20% |
| **External end semester university examination** The question paper will contain 05 short answer type questions ( without details explanation) of 04 marks each(No choice all compulsory), 03 short answer type questions ( without details explanation) of 08 marks each(No choice all compulsory), 04 long answer type questions( with analysis/explanation or critical analysis/evaluation) uniformly distributed in whole of the syllabus so as to cover the maximum topics in the syllabus. A candidate has | Upto 100% (90 lectures) | **2.5** hours | 80% |

to attempt any two questions carrying 18 marks each.

- Each lecture will be of one hour duration.

## SKILL ENHANCEMENT COURSE
### Semester VI

**Title of the Course/ Course Number: - Transportation and Game Theory / UMTTS605**

Internal Assessment Test: 20 Marks                                    Credits: 04

External End Semester University Examination: 80 Marks

( For the Examinations to be held in May 2019, 2020 and 2021 )

Transportation problem and its mathematical formulation, northwest-corner method, least cost method and Vogel approximation method for determination of starting basic solution, algorithm for solving transportation problem, assignment problem and its mathematical formulation, Hungarian method for solving assignment problem.

Game theory: formulation of two person zero sum games, solving two person zero sum games, games with mixed strategies, graphical solution procedure.

**Books Recommended**

- Mokhtar S. Bazaraa, John J. Jarvis and Hanif D. Sherali, Linear Programming and Network Flows, 2nd Ed., John Wiley and Sons, India, 2004.
- F. S. Hillier and G. J. Lieberman, Introduction to Operations Research, 9th Ed., Tata McGraw Hill, Singapore, 2009.
- Hamdy A. Taha, Operations Research, An Introduction, 8th Ed., Prentice- Hall India, 2006.

**Note:-**

- The evaluation of a candidate shall be awarded and record thereof maintained in accordance with the regulations prescribed for the purpose under CBCS as per the following:

| Theory | Syllabus to be covered in the examination | Time allotted | % Weightage(Marks) |
|---|---|---|---|
| **Internal Assessment Test**  The question paper will consist of two parts:<br>Part A: Total weightage of this part is 10 marks. It will contain 08 short answer type questions uniformly distributed in  50 % of the syllabus covered. A candidate has to attempt any five and each question carries 02 marks.<br>Part B: Total weightage of this part is 10 marks. It will contain 02 long answer type questions uniformly distributed in  50 % of the syllabus covered. A candidate has to attempt any one question and it carries 10 marks. | Upto 50% (after 45 lectures) | **1** hour | 20% |
| **External end semester university examination**  The question paper will contain 05 short answer type questions ( without details explanation) of 04 marks each(No choice all compulsory), 03 short answer type | Upto 100% (90 lectures) | **2.5** hours | 80% |

| questions ( without details explanation) of 08 marks each(No choice all compulsory), 04 long answer type questions( with analysis/explanation or critical analysis/evaluation) uniformly distributed in whole of the syllabus so as to cover the maximum topics in the syllabus. A candidate has to attempt any two questions carrying 18 marks each. | | | |
|---|---|---|---|

- Each lecture will be of one hour duration.

## SKILL ENHANCEMENT COURSE

### <u>Semester VI</u>

**Title of the Course/ Course Number: - Graph Theory / UMTTS606**

Internal Assessment Test: 20 Marks                    Credits: 04

External End Semester University Examination: 80 Marks

( For the Examinations to be held in May 2019, 2020 and 2021 )

Definition, examples and basic properties of graphs, pseudographs, complete graphs, bi-partite graphs, isomorphism of graphs, paths and circuits, Eulerian circuits, Hamiltonian cycles, the adjacency matrix, weighted graph, travelling salesman's problem, shortest path, Dijkstra's algorithm, Floyd-Warshall algorithm.

**Books Recommended**

- Edgar G. Goodaire and Michael M. Parmenter, Discrete Mathematics with Graph Theory 2nd Ed., Pearson Education (Singapore) P. Ltd., Indian Reprint, 2003.
- Rudolf Lidl and Günter Pilz, Applied Abstract Algebra, 2nd Ed., Undergraduate Texts in Mathematics, Springer (SIE), Indian reprint, 2004

**Note:-**

- The evaluation of a candidate shall be awarded and record thereof maintained in accordance with the regulations prescribed for the purpose under CBCS as per the following:

| Theory | Syllabus to be covered in the examination | Time allotted | % Weightage(Marks) |
|---|---|---|---|
| **Internal Assessment Test** The question paper will consist of two parts:<br>Part A: Total weightage of this part is 10 marks. It will contain 08 short answer type questions uniformly distributed in  50 % of the syllabus covered. A candidate has to attempt any five and each question carries 02 marks.<br>Part B: Total weightage of this part is 10 marks. It will contain 02 long answer type questions uniformly | Upto 50% (after 45 lectures) | **1** hour | 20% |

| | | | |
|---|---|---|---|
| distributed in 50 % of the syllabus covered. A candidate has to attempt any one question and it carries 10 marks. | | | |
| **External end semester university examination**<br>The question paper will contain 05 short answer type questions ( without details explanation) of 04 marks each(No choice all compulsory), 03 short answer type questions ( without details explanation) of 08 marks each(No choice all compulsory), 04 long answer type questions( with analysis/explanation or critical analysis/evaluation) uniformly distributed in whole of the syllabus so as to cover the maximum topics in the syllabus. A candidate has to attempt any two questions carrying 18 marks each. | Upto 100% (90 lectures) | **2.5** hours | 80% |

- Each lecture will be of one hour duration.