

BA/BCOM/B Sc/BVoc PROGRAM (4 years Honors)
Draft proforma for Syllabus framing
2020-21

| |
|--------------------|
| SUBJECT |
| MATHEMATICS |

| Members of BOS (Contact details) | | |
|----------------------------------|---|-------------|
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Note: BOS is to provide final soft copy in PDF and word formats and four copies of hard copies in bounded form to the office of Dean Academic affairs.

1. Resolutions of the Board of Studies

Meeting held on: ...22-1-2021.....Time:10 am At: Convention centre,
Adikavi Nannayya university,Rajahmundry

Agenda: Finalising the revised syllabus of UG Mathematics under CBCS frame work with effect from 2020-021.

Members present:

1. Dr.D.Chitti Babu, Convenor
2. Dr.D.Ch. Papa Rao, Member
3. Sri G.Sridhar, Member
4. Dr.K.Revathi, Coordinator

Resolutions:

After reviewing the existing titles and contents of classes I,II,III and IV framed by APSICHE, The board come out with the following resolutions.

Resolution-1

It is resolved to approve the following changes of courses I,II,III and IV of mathematics as it is given by APSICHE.

COURSE I:

1. Change of variables topic is deleted in Unit-I.
2. Orthogonal trajectories and equations that do not contain x or y topics are deleted in Unit-II.
3. Linear differential equations with non-constant coefficients is restricted to one Method only i.e. when part of C.F. is known.

COURSE II:

1. Simplified form of the equations of two spheres topic is deleted in Unit-IV
2. Limiting points topic is added in Unit IV.

COURSE III:

1. Homomorphism topic is shifted from Unit-III Unit-IV.
2. Cyclic groups topic is deleted in Unit-IV
3. Ideals topic is deleted in Unit-IV

COURSE IV:

1. Bolzano-Weierstrass theorem topic is deleted in Unit-I
2. Absolute convergence and conditional convergence topics are deleted in Unit-II
3. Uniform continuity topic is deleted in Unit-III.
4. Integral as the limit of a sum and mean value theorems topic is changed to first mean value theorem in Unit-V.

COURSE V:

1. Matrices, elementary properties, Inverse matrix, Rank of a matrix are deleted in Unit-IV

Resolution 2.

It is resolved to approve the necessary changes in Blue print and model papers of Courses I, II, III and IV. The paper setters should strictly follow the prescribed book and model papers

2. DETAILS OF PAPER TITLES & CREDITS

| Sem | Course no. | Course Name | Course type (T/L/P) | Hrs./ Week (Arts/ Commerce:5 and Science: 4+2) | Credits (Arts/ Commerce:4 and Science: 4+1) | Max. Marks Cont/ Internal/ Mid Assessment | Max. Marks Sem-end Exam |
|-----|------------|---|---------------------|--|---|---|-------------------------|
| I | I | Differential Equations | T and P | 6 | 5 | 25 | 75 |
| II | II | Three dimensional Analytical Solid Geometry | T and P | 6 | 5 | 25 | 75 |
| III | III | Abstract Algebra | T and P | 6 | 5 | 25 | 75 |
| IV | IV | Real Analysis | T and P | 6 | 5 | 25 | 75 |
| | V | Linear Algebra | T and P | 6 | 5 | 25 | 75 |
| V | - | - | - | - | - | - | - |
| | - | - | - | - | - | - | - |

Note: *Course type code: T: Theory, L: Lab, P: Problemsolving

- Proposed combination subjects: NIL
- Student eligibility for joining in the course: NIL
- Faculty eligibility for teaching the course NIL
- List of Proposed Skill enhancement courses with syllabus, if any NIL
- Any newly proposed Skill development/Life skill courses with draft syllabus and required resources NIL
- Required instruments/software/ computers for the course (Lab/Practical course-wise required i.e., for a batch of 15 students)

| Sem. No. | Lab/Practical Name | Names of Instruments/Software/ computers required with specifications | Brand Name | Qty Required |
|----------|--------------------|---|------------|--------------|
| 1 | Lab Name: | - | - | - |
| 2 | Lab Name: | -- | - | - |

- List of Suitable levels of positions eligible in the Govt/Pvt organizations

Suitable levels of positions for these graduates either in industry/govt organization like., technical assistants/ scientists/ school teachers., clearly define them, with reliable justification

| S.No | Position | Company/ Govt organization | Remarks | Additional skills required, if any |
|------|----------|----------------------------|---------|------------------------------------|
| - | - | - | - | - |
| - | - | - | - | - |

h. List of Govt. organizations / Pvt companies for employment opportunities or internships or projects

| S.No | Company/ Govt organization | Position type | Level of Position | | | |
|------|----------------------------|---------------|-------------------|---|---|---|
| - | - | - | - | - | - | - |
| - | - | - | - | - | - | - |

i. Any specific instructions to the teacher /paper setters/Exam-Chief Superintendent NIL.

3. Program objectives, outcomes, co-curricular and assessment methods

| BSc/BA/BCom | MATHEMATICS |
|-------------|-------------|
|-------------|-------------|

1. Aim and objectives of UG program in Subject: MATHEMATICS In this course UG program, student will learn the higher mathematics topics to enable to learn and solve problems in different fields.

2. Learning outcomes of Subject (in consonance with the Bloom's Taxonomy):

After successful completion of the course, the student will be able to

- 1 Solving linear differential equations.
2. Understand the concept and apply appropriate methods for solving differential equations.

3. Recommended Skill enhancement courses: (Titles of the courses given below and details of the syllabus for 4 credits (i.e., 2 units for theory and Lab/Practical) for 5 hrs class-cum-lab work NIL

4. Recommended Co-curricular activities:(Co-curricular Activities should not promote copying from text book or from others' work and shall encourage self/independent and group learning)

A. Measurable:

1. Assignments on: different topics of the subject.
2. Student seminars (Individual presentation of papers) on topics relating to:Mathematics subject.
3. Quiz Programmes on: different units of the course
4. Individual Field Studies/projects: study projects in different fields
5. Group discussion on: nil
6. Group/Team Projects on: nil

B General

1. Collection of news reports and maintaining a record of paper-cuttings relating to topics covered in syllabus. Yes
2. Group Discussions on: different areas of the subject
3. Watching TV discussions and preparing summary points recording personal observations etc., under guidance from the Lecturers Yes
4. Any similar activities with imaginative thinking. Nil

5. Recommended Continuous Assessment methods:

Thorough Assignments and seminars on different areas of the course and problem solving sessions in various unit of the course.

4. Details of course-wise Syllabus

ADIKAVINANNAYA UNIVERSITY
B.A./B.Sc. MATHEMATICS
REVISED SYLLABUS FOR CORE COURSES
CBCS/ SEMESTER SYSTEM
(w.e.f. 2020-21 Admitted Batch)
CORE COURSES STRUCTURE
(Sem-I to Sem-IV)

| Course | Subject | Hrs. | Credits | IA | ES | Total |
|-------------|---|------|---------|----|----|-------|
| Course -I | Differential Equations & Differential Equations Problem Solving Sessions | 6 | 5 | 25 | 75 | 100 |
| Course -II | Three dimensional analytical Solid geometry & Three dimensional analytical Solid Geometry Problem Solving Sessions | 6 | 5 | 25 | 75 | 100 |
| Course -III | Abstract Algebra & Abstract Algebra Problem Solving Sessions | 6 | 5 | 25 | 75 | 100 |
| Course -IV | Real Analysis & Real Analysis Problem Solving Sessions | 6 | 5 | 25 | 75 | 100 |
| Course -V | Linear Algebra & Linear Algebra Problem Solving Sessions | 6 | 5 | 25 | 75 | 100 |

COURSE-I
CBCS/ SEMESTER SYSTEM
B.A./B.Sc. MATHEMATICS (w.e.f. 2020-21 Admitted Batch)
DIFFERENTIAL EQUATIONS
SYLLABUS (75 Hours)

Course Outcomes:

After successful completion of this course, the student will be able to;

1. Solve linear differential equations
2. Convert non exact homogeneous equations to exact differential equations by using integrating factors
3. Know the methods of finding solutions of differential equations of the first order but not of the first Degree.
4. Solve higher-order linear differential equations, both homogeneous and non homogeneous, with constant coefficients.
5. Understand the concept and apply appropriate methods for solving differential equations.

Course Syllabus:

UNIT – I (12 Hours)

Differential Equations of first order and first degree:

Linear Differential Equations; Differential equations reducible to linear form; Exact differential equations; Integrating factors.

UNIT – II (12 Hours)

Differential Equations of first order but not of the first degree:

Equations solvable for p ; Equations solvable for y ; Equations solvable for x ; Equations homogeneous in x and y ; Equations of the first degree in x and y – Clairaut's Equation.

UNIT – III (12 Hours)

Higher order linear differential equations-I:

Solution of homogeneous linear differential equations of order n with constant coefficients; Solution of the non-homogeneous linear differential equations with constant coefficients by means of polynomial operators. General Solution of $f(D)y=0$.

General Solution of $f(D)y=Q$ when Q is a function of x , $\frac{1}{f(D)}$ is expressed as partial fractions

P.I. of $f(D)y = Q$ when $Q = be^{ax}$

P.I. of $f(D)y = Q$ when Q is $b\sin ax$ or $b \cos ax$.

UNIT – IV (12 Hours)

Higher order linear differential equations-II:

Solution of the non-homogeneous linear differential equations with constant coefficients.

P.I. of $f(D)y = Q$ when $Q = bx^k$

P.I. of $f(D)y = Q$ when $Q = e^{ax} V$, where V is a function of x .

P.I. of $f(D)y = Q$ when $Q = xV$, where V is a function of x .

P.I. of $f(D)y = Q$ when $Q = x^m V$, where V is a function of x .

UNIT –V (12 Hours)

Higher order linear differential equations-III :

Method of variation of parameters; Linear differential Equations with non-constant coefficients(Solution when a part of CF is known method only); The Cauchy-Euler Equation, Legendre's linear equations.

Co-Curricular Activities(15 Hours)

Seminar/ Quiz/ Assignments/ Applications of Differential Equations to Real life Problem /Problem Solving.

Text Book :

Differential Equations and Their Applications by Zafar Ahsan, published by Prentice-Hall of India Pvt. Ltd, New Delhi-Second edition.

Reference Books :

1. A text book of Mathematics for B.A/B.Sc, Vol 1, by N. Krishna Murthy & others, published by S.Chand & Company, New Delhi.
2. Ordinary and Partial Differential Equations by Dr. M.D,Raisinghania, published by S. Chand & Company, New Delhi.
3. Differential Equations with applications and programs – S. Balachandra Rao & HR Anuradha Universities Press.
4. Differential Equations -Srinivas Vangala & Madhu Rajesh, published by Spectrum University Press.

COURSE-II
CBCS/ SEMESTER SYSTEM (w.e.f. 2020-21 Admitted Batch)
B.A./B.Sc. MATHEMATICS
THREE DIMENSIONAL ANALYTICAL SOLID GEOMETRY
Syllabus (75 Hours)

Course Outcomes:

After successful completion of this course, the student will be able to;

1. get the knowledge of planes.
2. basic idea of lines, sphere and cones.
3. understand the properties of planes, lines, spheres and cones.
4. express the problems geometrically and then to get the solution.

Course Syllabus:

UNIT – I (12 Hours)

The Plane: Equation of plane in terms of its intercepts on the axis, Equations of the plane through the given points, Length of the perpendicular from a given point to a given plane, Bisectors of angles between two planes, Combined equation of two planes, Orthogonal projection on a plane.

UNIT – II (12 hrs)

The Line :Equation of a line; Angle between a line and a plane; The condition that a given line may lie in a given plane; The condition that two given lines are coplanar; Number of arbitrary constants in the equations of straight line; Sets of conditions which determine a line; The shortest distance between two lines; The length and equations of the line of shortest distance between two straight lines; Length of the perpendicular from a given point to a given line.

UNIT – III (12 hrs)

The Sphere :

Definition and equation of the sphere; Equation of the sphere through four given points; Plane sections of a sphere; Intersection of two spheres; Equation of a circle; Sphere through a given circle;

Intersection of a sphere and a line; Power of a point; Tangent plane; Plane of contact; Polar plane; Pole of a Plane; Conjugate points; Conjugate planes;

UNIT – IV (12 hrs)

The Sphere and Cones :

Angle of intersection of two spheres; Conditions for two spheres to be orthogonal; Radical plane; Coaxial system of spheres. Limiting Points.

Definitions of a cone; vertex; guiding curve; generators; Equation of the cone with a given vertex and guiding curve; equations of cones with vertex at origin are homogenous; Condition that the general equation of the second degree should represent a cone;

UNIT – V (12 hrs)

Cones :Enveloping cone of a sphere; right circular cone: equation of the right circular cone with a given vertex, axis and semi vertical angle: Condition that a cone may have three mutually perpendicular generators; intersection of a line and a quadric cone; Tangent lines and tangent plane at a point; Condition that a plane may touch a cone; Reciprocal cones; Intersection of two cones with a common vertex.

Co-Curricular Activities(15 Hours)

Seminar/ Quiz/ Assignments/Three dimensional analytical Solid geometry and its applications/ Problem Solving.

Text Book :

Analytical Solid Geometry by Shanti Narayan and P.K. Mittal, published by S. Chand & Company Ltd. 7th Edition.

Reference Books :

1. A text book of Mathematics for BA/B.Sc Vol 1, by V Krishna Murthy & Others, published by S. Chand & Company, New Delhi.
2. A text Book of Analytical Geometry of Three Dimensions, by P.K. Jain and Khaleel Ahmed, published by Wiley Eastern Ltd., 1999.
3. Co-ordinate Geometry of two and three dimensions by P. Balasubrahmanyam, K.Y. Subrahmanyam, G.R. Venkataraman published by Tata-MC Gran-Hill Publishers Company Ltd., New Delhi.
4. Solid Geometry by B.Rama Bhupal Reddy, published by Spectrum University Press.

COURSE-III
CBCS/ SEMESTER SYSTEM(w.e.f. 2020-21 Admitted Batch)
B.A./B.Sc. MATHEMATICS
ABSTRACT ALGEBRA
SYLLABUS (75 Hours)

Course Outcomes:

After successful completion of this course, the student will be able to;

1. acquire the basic knowledge and structure of groups, subgroups and cyclic groups.
2. get the significance of the notation of a normal subgroups.
3. get the behavior of permutations and operations on them.
4. study the homomorphisms and isomorphisms with applications.
5. Understand the ring theory concepts with the help of knowledge in group theory and to prove the theorems.
6. Understand the applications of ring theory in various fields.

Course Syllabus:

UNIT – I (12 Hours)

GROUPS : Binary Operation – Algebraic structure – semi group-monoid – Group definition and elementary properties Finite and Infinite groups – examples – order of a group, Composition tables with examples.

UNIT – II (12 Hours)

SUBGROUP

Complex Definition – Multiplication of two complexes Inverse of a complex-Subgroup definition- examples-criterion for a complex to be a subgroups. Criterion for the product of two subgroups to be a subgroup-union and Intersection of subgroups.

Co-sets and Lagrange's Theorem:

Cosets Definition – properties of Cosets–Index of a subgroups of a finite groups–Lagrange's Theorem.

UNIT –III (12 Hours)

NORMAL SUBGROUPS: Definition of normal subgroup – proper and improper normal subgroup–Hamilton group – criterion for a subgroup to be a normal subgroup – intersection of two normal subgroups – Sub group of index 2 is a normal sub group –quotient group – criteria for the existence of a quotient group.

UNIT – IV (12 Hours)

HOMOMORPHISM :Definition of homomorphism – Image of homomorphism elementary properties of homomorphism – Isomorphism – automorphism definitions and elementary properties–kernel of a homomorphism – fundamental theorem on Homomorphism and applications.

PERMUTATIONS:

Definition of permutation – permutation multiplication – Inverse of a permutation – cyclic permutations – transposition – even and odd permutations – Cayley’s theorem.

UNIT – V (12 Hours)

RINGS Definition of Ring and basic properties, Boolean Rings, divisors of zero and cancellation laws Rings, Integral Domains, Division Ring and Fields, The characteristic of a ring - The characteristic of an Integral Domain, The characteristic of a Field. Sub Rings.

Co-Curricular Activities(15 Hours)

Seminar/ Quiz/ Assignments/ Group theory and its applications / Problem Solving.

Text Book :

A text book of Mathematics for B.A. / B.Sc. by B.V.S.S. SARMA and others, published by S.Chand & Company, New Delhi.

Reference Books :

1. Abstract Algebra by J.B. Fraleigh, Published by Narosa publishing house.
2. Modern Algebra by M.L. Khanna.
3. Rings and Linear Algebra by Pundir & Pundir, published by Pragathi Prakashan.

COURSE-IV
CBCS/ SEMESTER SYSTEM (w.e.f. 2020-21 Admitted Batch)
B.A./B.Sc. MATHEMATICS REAL ANALYSIS
SYLLABUS (75 Hours)

Course Outcomes:

After successful completion of this course, the student will be able to

1. get clear idea about the real numbers and real valued functions.
2. obtain the skills of analyzing the concepts and applying appropriate methods for testing convergence of a sequence/ series.
3. Test the continuity and differentiability and Riemann integration of a function.
4. Know the geometrical interpretation of mean value theorems.

Course Syllabus:

UNIT – I (12 Hours)

Introduction of Real Numbers (No question is to be set from this portion)

Real Sequences:

Sequences and their limits, Range and Boundedness of Sequences, Limit of a sequence and Convergent sequence. The Cauchy's criterion, properly divergent sequences, Monotone sequences, Necessary and Sufficient condition for Convergence of Monotone Sequence, Limit Point of Sequence, Subsequences, Cauchy Sequences – Cauchy's general principle of convergence theorem.

UNIT –II (12 Hours)

INFINITE SERIES

:

Series : Introduction to series, convergence of series. Cauchy's general principle of convergence for series tests for convergence of series, Series of Non-Negative Terms.

1. P-test
2. Cauchy's n^{th} root test or Root Test.
3. D'Alembert's Test or Ratio Test.
4. Alternating Series – Leibnitz Test.

UNIT – III (12 Hours)

CONTINUITY:

Limits: Real valued Functions, Boundedness of a function, Limits of functions. Some extensions of the limit concept, Infinite Limits. Limits at infinity. (No question is to be set from this portion).

Continuous functions: Continuous functions, Combinations of continuous functions, Continuous Functions on interval.

UNIT – IV (12 Hours)

DIFFERENTIATION AND MEAN VALUE THEOREMS: The derivability of a function, on an interval, at a point, Derivability and continuity of a function, Graphical meaning of the Derivative, Mean value Theorems; Rolle's Theorem, Lagrange's Theorem, Cauchy's Mean value Theorem

UNIT – V (12 Hours)

RIEMANN INTEGRATION :

Riemann Integral, Riemann integral functions, Darboux theorem. Necessary and sufficient condition for R – integrability, Properties of integrable functions, Fundamental theorem of integral calculus, First mean value Theorem.

Co-Curricular Activities(15 Hours)

Seminar/ Quiz/ Assignments/ Real Analysis and its applications / Problem Solving.

Text Book:

Introduction to Real Analysis by Robert G.Bartle and Donlad R. Sherbert, published by John Wiley.

Reference Books:

1. A Text Book of B.Sc Mathematics by B.V.S.S. Sarma and others, published by S. Chand & Company Pvt. Ltd., New Delhi.
2. Elements of Real Analysis as per UGC Syllabus by Shanthi Narayan and Dr. M.D. Raisinghania, published by S. Chand & Company Pvt. Ltd., New Delhi.

COURSE-V
CBCS/ SEMESTER SYSTEM (w.e.f. 2020-21 Admitted Batch)
B.A./B.Sc. MATHEMATICS
LINEAR ALGEBRA
SYLLABUS (75 Hours)

Course Outcomes:

After successful completion of this course, the student will be able to;

1. understand the concepts of vector spaces, subspaces, bases, dimension and their properties
2. understand the concepts of linear transformations and their properties
3. apply Cayley- Hamilton theorem to problems for finding the inverse of a matrix and higher powers of matrices without using routine methods
4. Learn the properties of inner product spaces and determine orthogonality in inner product spaces.

Course Syllabus:

UNIT – I (12 Hours)

Vector Spaces-I:

Vector Spaces, General properties of vector spaces, n-dimensional Vectors, addition and scalar multiplication of Vectors, internal and external composition, Null space, Vector subspaces, Algebra of subspaces, Linear Sum of two subspaces, linear combination of Vectors, Linear span Linear independence and Linear dependence of Vectors.

UNIT –II (12 Hours)

Vector Spaces-II:

Basis of Vector space, Finite dimensional Vector spaces, basis extension, co-ordinates, Dimension of a Vector space, Dimension of a subspace, Quotient space and Dimension of Quotient space.

UNIT –III (12 Hours)

Linear Transformations:

Linear transformations, linear operators, Properties of L.T, sum and product of LTs, Range and null space of linear transformation, Rank and Nullity of linear transformations – Rank – Nullity Theorem.

UNIT –IV (12 Hours)

Matrix :

Linear Equations, Characteristic equations, Characteristic Values & Vectors of square matrix, Cayley – Hamilton Theorem.

UNIT –V (12 Hours)

Inner product space : Inner product spaces, Euclidean and unitary spaces, Norm or length of a Vector, Schwartz inequality, Triangle Inequality, Parallelogram law, Orthogonality, Orthonormal set, Gram– Schmidt orthogonalisation process. Bessel's inequality and Parseval's Identity.

Co-Curricular Activities(15 Hours)

Seminar/ Quiz/ Assignments/ Linear algebra and its applications / Problem Solving.

Text Book:

Linear Algebra by J.N. Sharma and A.R. Vasista, published by Krishna Prakashan Mandir, Meerut- 250002.

Reference Books:

1. Matrices by Shanti Narayana, published by S.Chand Publications.
2. Linear Algebra by Kenneth Hoffman and Ray Kunze, published by Pearson Education (low priced edition), New Delhi.
3. Linear Algebra by Stephen H. Friedberg et. al. published by Prentice Hall of India Pvt. Ltd. 4th Edition, 2007.

Recommended Question Paper Patterns and Models
BLUE PRINT FOR QUESTION PAPER PATTERN
COURSE-I, DIFFERENTIAL EQUATIONS

| Unit | TOPIC | S.A.Q (including choice) | E.Q (including choice) | Total Marks |
|--------------|--|--------------------------------|------------------------------|----------------|
| I | Differential Equations of 1 st order and 1 st Degree | 2 | 2 | 30 |
| II | Differential Equations of 1 st order but not of 1 st degree | 1 | 2 | 25 |
| III | Higher Order Linear Differential Equations (with constant coefficients) – I | 2 | 2 | 30 |
| IV | Higher Order Linear Differential Equations (with constant coefficients) – II | 2 | 2 | 30 |
| V | Higher Order Linear Differential Equations (with non constant coefficients) | 1 | 2 | 25 |
| TOTAL | | 8 | 1 | 140 |

S.A.Q. = Short answer questions (5 marks)

E.Q. = Essay questions (10 marks)

Short answer questions : 5 X 5 M = 25 M

Essay questions : 5 X 10 M = 50 M

.....

Total Marks = 75 M

.....

CBCS/ SEMESTER SYSTEM
(W.e.f 2020-21 Admitted Batch)
B.A./B.Sc. MATHEMATICS

COURSE-I, DIFFERENTIAL EQUATIONS

MATHEMATICS MODEL PAPER

Time: 3Hrs

Max.Marks:75M

SECTION - A

Answer any FIVE questions. Each question carries FIVE marks

5 X 5 M=25 M

1. Solve $(1 + e^{x/y})dx + e^{x/y} \left(1 - \frac{x}{y}\right) dy = 0$
2. Solve $(y - e^{\sin^{-1}x}) \frac{dx}{dy} + \sqrt{1 - x^2} = 0$
3. Solve $\sin px \cos y = \cos px \sin y + p$.
4. Solve $[D^2 - (a + b)D + ab]y = 0$
5. Solve $(D^2 - 3D + 2)y = \cosh x$
6. Solve $(D^2 - 4D + 3)y = \sin 3x \cos 2x$.
7. Solve $\frac{d^2y}{dx^2} - 6 \frac{dy}{dx} + 13y = 8 e^{3x} \sin 2x$.
8. Solve $x^2y'' - 2x(1 + x)y' + 2(1 + x)y = x^3$

SECTION - B

Answer ALL the questions. Each question carries TEN marks.

5 X 10 M = 50 M

9. (a) Solve $x \frac{dy}{dx} + y = y^2 \log x$.
(Or)
(b) Solve $\left(y + \frac{y^3}{3} + \frac{x^2}{2}\right) dx + \frac{1}{4}(x + xy^2)dy = 0$
10. (a) Solve $p^2 + 2p \cot x = y^2$.
(Or)
(b) Solve $y + Px = P^2x^4$

11. (a) Solve $(D^3 + D^2 - D - 1)y = \cos 2x$.11

(OR)

(b) Solve $(D^2 - 3D + 2)y = \sin e^{-x}$.

12. (a) Solve $(D^2 - 2D + 4)y = 8(x^2 + e^{2x} + \sin 2x)$

(Or)

(b) Solve $\frac{d^2y}{dx^2} + 3\frac{dy}{dx} + 2y = xe^x \sin x$

13. (a) Solve $(D^2 - 2D) y = e^x \sin x$ by the method of variation of parameters.

(Or)

(b) Solve $3x^2 \frac{d^2y}{dx^2} + x \frac{dy}{dx} + y = x$

BLUE PRINT FOR QUESTION PAPER PATTERN
COURSE-II, THREE DIMENSIONAL ANALYTICAL SOLID GEOMETRY

| Unit | TOPIC | S.A.Q (including choice) | E.Q (including choice) | Total Marks |
|--------------|-----------------------------|-------------------------------------|-----------------------------------|--------------------|
| I | The Plane | 2 | 2 | 30 |
| II | The Right Line | 2 | 2 | 30 |
| III | The Sphere | 2 | 2 | 30 |
| IV | The Sphere & The Cone | 1 | 2 | 25 |
| V | The Cone | 1 | 2 | 25 |
| Total | | 8 | 10 | 140 |

S.A.Q. = Short answer questions (5 marks)

E.Q. = Essay questions (10 marks)

Short answer questions : 5 X 5 M = 25 M

Essay questions : 5 X 10 M = 50 M

.....
 Total Marks = 75 M

CBCS/ SEMESTER SYSTEM
(w.e.f. 2020-21 Admitted Batch)
B.A./B.Sc. MATHEMATICS

COURSE-II, THREE DIMENSIONAL ANALYTICAL SOLID GEOMETRY

Time: 3Hrs

Max.Marks:75 M

SECTION - A

Answer any FIVE questions. Each question carries FIVE marks 5 X 5 M=25 M

1. Find the equation of the plane through the point (-1,3,2) and perpendicular to the planes $x+2y+2z=5$ and $3x+3y+2z=8$.
2. Find the bisecting plane of the acute angle between the planes $3x-2y-6z+2=0, -2x+y-2z-2=0$.
3. Find the image of the point (2,-1,3) in the plane $3x-2y+z=9$.
4. Show that the lines $2x + y - 4 = 0 = y + 2z$ and $x + 3z - 4 = 0, 2x + 5z - 8 = 0$ are coplanar.
5. A variable plane passes through a fixed point (a, b, c). It meets the axes in A, B, C. Show that the centre of the sphere OABC lies on $ax^{-1}+by^{-1}+cz^{-1}=2$.
6. Show that the plane $2x-2y+z+12=0$ touches the sphere $x^2+y^2+z^2-2x-4y+2z-3=0$ and find the point of contact.
7. Find the equation to the cone which passes through the three coordinate axes and the lines $\frac{x}{1} = \frac{y}{-2} = \frac{z}{3}$ and $\frac{x}{2} = \frac{y}{1} = \frac{z}{1}$
8. Find the equation of the enveloping cone of the sphere $x^2 + y^2 + z^2 + 2x - 2y = 2$ with its vertex at (1, 1, 1).

SECTION - B

Answer ALL the questions. Each question carries TEN marks. 5 X 10 M = 50 M

9. (a) A plane meets the coordinate axes in A, B, C. If the centroid of $\triangle ABC$ is (a,b,c), show that the Equation of the plane is $\frac{x}{a} + \frac{y}{b} + \frac{z}{c} = 3$.
(OR)
(b) A variable plane is at a constant distance p from the origin and meets the axes in A,B,C. Show that The locus of the centroid of the tetrahedron OABC is $x^{-2}+y^{-2}+z^{-2}=16p^{-2}$.

10. (a) Find the shortest distance between the lines $\frac{x-3}{3} = \frac{y-8}{-1} = \frac{z-3}{1}$; $\frac{x+3}{-3} = \frac{y+7}{2} = \frac{z-6}{4}$.

(OR)

(b) Prove that the lines $\frac{x-1}{2} = \frac{y-2}{3} = \frac{z-3}{4}$; $\frac{x-2}{3} = \frac{y-3}{4} = \frac{z-4}{5}$ are coplanar. Also find their point of intersection and the plane containing the lines.

11. (a) Show that the two circles $x^2+y^2+z^2-y+2z=0$, $x-y+z=2$; $x^2+y^2+z^2+x-3y+z-5=0$, $2x-y+4z-1=0$ lie on the same sphere and find its equation.

(OR)

(b) Find the equation of the sphere which touches the plane $3x+2y-z+2=0$ at $(1,-2,1)$ and cuts orthogonally

The sphere $x^2+y^2+z^2-4x+6y+4=0$.

12. (a) Find the limiting points of the coaxial system of spheres $x^2+y^2+z^2-8x+2y-2z+32=0$, $x^2+y^2+z^2-7x+z+23=0$.

(OR)

(b) Find the equation to the cone with vertex is the origin and whose base curve is $x^2+y^2+z^2+2ux+d=0$.

13. (a) Prove that the equation $\sqrt{fx} \pm \sqrt{gy} \pm \sqrt{hz} = 0$ represents a cone that touches the coordinate Planes and find its reciprocal cone.

(OR)

(b) Find the equation of the sphere $x^2+y^2+z^2-2x+4y-1=0$ having its generators parallel to the line $x=y=z$.

BLUE PRINT FOR QUESTION PAPER PATTERN
COURSE-III, ABSTRACT ALGEBRA

| Unit | TOPIC | S.A.Q(including choice) | E.Q(including choice) | Total Marks |
|-------------|--|--------------------------------|------------------------------|--------------------|
| I | Groups | 2 | 2 | 30 |
| II | Subgroups, Cosets & Lagrange's theorem | 1 | 2 | 25 |
| III | Normal Subgroups | 1 | 2 | 25 |
| IV | Homomorphism and Permutations | 2 | 2 | 30 |
| V | Rings | 2 | 2 | 30 |
| Total | | 8 | 10 | 140 |

S.A.Q. = Short answer questions (5 marks)

E.Q. = Essay questions (10 marks)

Short answer questions : 5 X 5 M = 25 M

Essay questions : 5 X 10 M = 50 M

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Total Marks = 75 M
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CBCS/ SEMESTER SYSTEM
(w.e.f. 2020-21 Admitted Batch)
B.A./B.Sc. MATHEMATICS
COURSE-III, ABSTRACT ALGEBRA

Time: 3Hrs

Max.Marks:75M

SECTION - A

Answer any **FIVE** questions. Each question carries **FIVE** marks 5 X 5 M=25 M

1. Show that the set $G = \{x/x = 2^a 3^b \text{ and } a, b \in \mathbb{Z}\}$ is a group under multiplication
2. Define order of an element. In a group G, prove that if $a \in G$ then $O(a) = O(a)^{-1}$.
3. If H and K are two subgroups of a group G, then prove that HK is a subgroup $\Leftrightarrow HK=KH$
4. If G is a group and H is a subgroup of index 2 in G then prove that H is a normal subgroup.
5. Examine whether the following permutations are even or odd
 - i) $\begin{pmatrix} 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 \\ 6 & 1 & 4 & 3 & 2 & 5 & 7 & 8 & 9 \end{pmatrix}$
 - ii) $\begin{pmatrix} 1 & 2 & 3 & 4 & 5 & 6 & 7 \\ 3 & 2 & 4 & 5 & 6 & 7 & 1 \end{pmatrix}$
6. If f is a homomorphism of a group G into a group G', then prove that the kernel of f is a normal of G.
7. Prove that the characteristic of an integral domain is either prime or zero.
8. Define a Boolean Ring and Prove that the Characteristic of a Boolean Ring is 2.

SECTION - B

Answer **ALL** the questions. Each question carries **TEN** marks.

5 X 10 M = 50 M

9. a) Show that the set of n^{th} roots of unity forms an abelian group under multiplication.
(Or)
b) In a group G, for $a, b \in G$, $O(a)=5$, $b \neq e$ and $aba^{-1} = b^2$. Find $O(b)$.
10. a) The Union of two subgroups is also a subgroup \square one is contained in the other.
(Or)
b) State and prove Lagrange's theorem.
11. a) Prove that a subgroup H of a group G is a normal subgroup of G iff the product of two right cosets of H in G is again a right coset of H in G.
(Or)
b) Define Normal Subgroup. Prove that a subgroup H of a group G is normal iff $xHx^{-1} = H \forall x \in G$.
12. a) State and prove fundamental theorem of homomorphisms of groups.
(Or)
b) Let S_n be the symmetric group on n symbols and let A_n be the group of even permutations. Then show that A_n is normal in S_n and $O(A_n) = \frac{1}{2}(n!)$
13. a) Prove that every finite integral domain is a field.
(Or)
b) Let S be a non empty sub set of a ring R. Then prove that S is a sub ring of R if and only if $a-b \in S$ and $ab \in S$ for all $a, b \in S$.

BLUE PRINT FOR QUESTION PAPER PATTERN
COURSE-IV, REAL ANALYSIS

| Unit | TOPIC | S.A.Q(including choice) | E.Q(including choice) | Total Marks |
|-------------|--|--------------------------------|------------------------------|--------------------|
| I | Real Sequence | 1 | 2 | 25 |
| II | Infinite Series | 2 | 2 | 30 |
| III | Limits and Continuity | 1 | 2 | 25 |
| IV | Differentiation and Mean Value Theorem | 2 | 2 | 30 |
| V | Riemann Integration | 2 | 2 | 30 |
| | TOTAL | 8 | 10 | 140 |

S.A.Q. = Short answer questions (5 marks)

E.Q. = Essay questions (10 marks)

Short answer questions : 5 X 5 M = 25 M

Essay questions : 5 X 10 M = 50 M

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Total Marks = 75 M
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CBCS/ SEMESTER SYSTEM
(w.e.f. 2020-21 Admitted Batch)
B.A./B.Sc. MATHEMATICS
COURSE-IV, REAL ANALYSIS

Time: 3Hrs

Max.Marks:75M

SECTION - A

Answer any FIVE questions. Each question carries FIVE marks 5 X 5 M=25 M

1. Prove that every convergent sequence is bounded.
2. Examine the convergence of $\frac{1}{1.2} - \frac{1}{3.4} + \frac{1}{5.6} - \frac{1}{7.8} + \dots$
3. Test the convergence of the series $\sum_{n=1}^{\infty} (\sqrt[3]{n^3 + 1} - n)$.
4. Examine for continuity of the function f defined by $f(x) = |x| + |x - 1|$ at $x=0$ and 1 .
5. Show that $f(x) = x \sin \frac{1}{x}$, $x \neq 0$; $f(x) = 0$, $x = 0$ is continuous but not derivable at $x=0$.
6. Verify Rolle's theorem for the function $f(x) = x^3 - 6x^2 + 11x - 6$ on $[1, 3]$.
7. If $f(x) = x^2 \forall x \in [0, 1]$ and $p = \{0, \frac{1}{4}, \frac{2}{4}, \frac{3}{4}, 1\}$ then find $L(p, f)$ and $U(p, f)$.
8. Prove that if $f: [a, b] \rightarrow \mathbb{R}$ is continuous on $[a, b]$ then f is R- integrable on $[a, b]$.

SECTION -B

Answer ALL the questions. Each question carries TEN marks. 5 X 10 M = 50 M

9. (a) If $S_n = 1 + \frac{1}{2!} + \frac{1}{3!} + \dots + \frac{1}{n!}$ then show that $\{S_n\}$ converges.
 (OR)

(b) State and prove Cauchy's general principle of convergence.

10. (a) State and Prove Cauchy's nth root test.
 (OR)

(b) Test the convergence of $\sum \frac{x^n}{x^n + a^n}$ ($x > 0, a > 0$)

11. (a) Let $f: \mathbb{R} \rightarrow \mathbb{R}$ be such that

$$f(x) = \frac{\sin(a+1)x + \sin x}{x} \text{ for } x < 0$$

$$= c \text{ for } x = 0$$

$$= \frac{(x+bx^2)^{1/2} - x^{1/2}}{bx^{3/2}} \text{ for } x > 0$$

Determine the values of a, b, c for which the function f is continuous at $x=0$.

(OR)

(b) If $f: [a, b] \rightarrow \mathbb{R}$ is continuous on $[a, b]$ then prove that f is bounded on $[a, b]$

12. (a) Using Lagrange's theorem, show that $x > \log(1 + x) > \frac{x}{(1+x)} \forall x > 0$.

(OR)

(b) State and prove Cauchy's mean value theorem...

13. (a) State and prove Riemann's necessary and sufficient condition for R- integrability.

(OR)

(b) Prove that $\frac{\pi^3}{24} \leq \int_0^\pi \frac{x^2}{5+3\cos x} dx \leq \frac{\pi^3}{6}$

BLUE PRINT FOR QUESTION PAPER PATTERN
COURSE-V, LINEAR ALGEBRA

| Unit | TOPIC | S.A.Q (including choice) | E.Q (including choice) | Marks Allotted |
|-------|-----------------------|--------------------------------|------------------------------|-------------------|
| I | Vector spaces - I | 2 | 2 | 30 |
| II | Vector spaces - II | 1 | 2 | 25 |
| III | Linear Transformation | 2 | 2 | 30 |
| IV | Matrices | 1 | 2 | 25 |
| V | Inner product spaces | 2 | 2 | 30 |
| Total | | 8 | 10 | 140 |

S.A.Q. = Short answer questions (5 marks)

E.Q. = Essay questions (10 marks)

Short answer questions : 5 X 5 M = 25 M

Essay questions : 5 X 10 M = 50 M

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Total Marks = 75 M
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CBCS/ SEMESTER SYSTEM
(w.e.f. 2020-21 Admitted
Batch) B.A./B.Sc.
MATHEMATICS
COURSE-V
LINEAR ALGEBRA

Time: 3Hrs

Max.Marks:75

SECTION - A

Answer any FIVE questions. Each question carries FIVE marks 5 X 5M=25 M

1. Let p, q, r be fixed elements of a field F. Show that the set W of all triads (x, y, z) of elements of F, such that $px+qy+rz=0$ is a vector subspace of $V_3(R)$.
2. Define linearly independent & linearly dependent vectors in a vector space. If α, β, γ are linearly independent vectors of $V(R)$ then show that $\alpha+\beta, \beta+\gamma, \gamma+\alpha$ are also linearly independent.
3. Prove that every set of $(n+1)$ or more vectors in an n dimensional vector space is linearly dependent.
4. The mapping $T: V_3(R) \rightarrow V_3(R)$ is defined by $T(x,y,z) = (x-y, x-z)$. Show that T is a linear transformation.
5. Let $T: R^3 \rightarrow R^2$ and $H: R^3 \rightarrow R^2$ be defined by $T(x, y, z) = (3x, y+z)$ and $H(x, y, z) = (2x-z, y)$. Compute i) $T+H$ ii) $4T-5H$ iii) TH iv) HT .
6. If the matrix A is non-singular, show that the eigen values of A^{-1} are the reciprocals of the eigen values of A.
7. State and prove parallelogram law in an inner product space $V(F)$.
8. Prove that the set $S = \left\{ \left(\frac{1}{3}, \frac{-2}{3}, \frac{-2}{3} \right), \left(\frac{2}{3}, \frac{-1}{3}, \frac{2}{3} \right), \left(\frac{2}{3}, \frac{2}{3}, \frac{-1}{3} \right) \right\}$ is an orthonormal set in the inner product space $R^3(R)$ with the standard inner product.

SECTION - B

Answer ALL the questions. Each question carries TEN marks. 5 X 10 M = 50 M

9. (a) Define vector space. Let $V(F)$ be a vector space. Let W be a non empty sub set of V. Prove that the Necessary and sufficient condition for W to be a subspace of V is $a, b \in F$ and $\alpha, \beta \in V \Rightarrow a\alpha + b\beta \in W$
 (OR)
 (b) Prove that the four vectors (1,0,0), (0,1,0), (0,0,1) and (1,1,1) of $V_3(C)$ form linearly dependent set, but any three of them are linearly independent.
10. (a) Define dimension of a finite dimensional vector space. If W is a subspace of a finite Dimensional vector space V (F) then prove that W is finite dimensional and $\dim W \leq n$.
 (OR)

(b) If W be a subspace of a finite dimensional vector space $V(F)$ then Prove that

$$\dim V/W = \dim V - \dim W$$

11. (a) Find $T(x, y, z)$ where $T: \mathbb{R}^3 \rightarrow \mathbb{R}$ is defined by $T(1, 1, 1) = 3$, $T(0, 1, -2) = 1$,
 $T(0, 0, 1) = -2$

(OR)

(b) State and prove Rank Nullity theorem.

12. (a) Find the eigen values and the corresponding eigen vectors of the matrix $A = \begin{pmatrix} 8 & -6 & 2 \\ -6 & 7 & -4 \\ 2 & -4 & 3 \end{pmatrix}$

(OR)

(b) State and prove Cayley-Hamilton theorem.

13. (a) State and prove Schwarz's inequality in an Inner product space $V(F)$.

(OR)

- (b) Given $\{(2, 1, 3), (1, 2, 3), (1, 1, 1)\}$ is a basis of $\mathbb{R}^3(\mathbb{R})$. Construct an orthonormal basis using Gram-Schmidt orthogonalisation process.

5. Recommended Co-curricular activities: (Co-curricular Activities should not promote copying from text book or from others' work and shall encourage self/independent and group learning)

A. Measurable:

1. Assignments on: different topics of the subject
2. Student seminars (Individual presentation of papers) on topics relating to: Different areas of the subject.
3. Quiz Programmes on: Various fields of the mathematics
4. Individual Field Studies/projects: Study projects in mathematics course
5. Group discussion on: -nil
6. Group/Team Projects on: nil

B. General

1. Collection of news reports and maintaining a record of paper-cuttings relating to topics covered in syllabus
2. Group Discussions on: Different fields of the subject
3. Watching TV discussions and preparing summary points recording personal observations etc., under guidance from the Lecturers -
4. Any similar activities with imaginative thinking. -nil

6. Recommended Continuous Assessment methods:
Problem solving in different methods of the course

7. DETAILS OF SYLLABUS ON SKILL ENHANCEMENT COURSES AND MODEL QUESTION PAPERS FOR THEORY AND LAB

NIL