Bharathiar University :: Coimbatore – 641 046

Regulations for B. Sc. Mathematics with Computer Applications Degree Course
Semester System
(with effect from 2007-2008)

1. Eligibility for Admission to the Course
Candidate for admission to the first year of the B. Sc. Mathematics with CA degree course shall be required to have passed the higher secondary examination conducted by the Govt. of Tamil Nadu with Mathematics as one of papers only eligible or other examinations accepted as equivalent there to by the Syndicate, subject to such other conditions as may be prescribed therefor. Business Mathematics, General Mathematics and Statistics subject at HSC can not be considered as equivalent to Mathematics.

2. Duration of the Course
The course shall extend over a period of three years comprising of six semesters with two semesters in one academic year. There shall not be less than 90 working days for each semester. Examination shall be conducted at the end of every semester for the respective subjects.

3. Course of Study
The course of study for the UG degree course shall consist of the following

a) Part - I
Tamil or any one of the following modern/classical languages i.e. Telugu, Kannada, Malayalam, Hindi, Sanskrit, French, German, Arabic & Urdu. It shall be offered for the first two semesters with one examination at the end of each semester.

b) Part – II : English
The subject shall be offered during the first two semesters with one examination at the end of each semester. During third semester the subject communication skills will be offered as one of the core subject.

c) Foundation Course
The Foundation course shall comprise of two stages as follows:
Foundation Course A : General Awareness (I & II semesters)
Foundation Course B : Environmental Studies (III & IV semesters)

The syllabus and scheme of examination for the foundation course A, General awareness shall be apportioned as follows.
From the printed material supplied by the University - 75%
Current affairs & who is who? - 25%
The current affairs cover current developments in all aspects of general knowledge which are not covered in the printed material on this subject issued by the University.
The Foundation course B shall comprise of only one paper which shall have Environmental Studies.

d) **Part – III**

**Group A:** Core subject – As prescribed in the scheme of examination.
Examination will be conducted in the core subjects at the end of every semester

**Group B:** allied subjects -2 subjects-4 papers
Examination shall be conducted in the allied subjects at the end of first four semesters.

**Group C:** application oriented subjects: 2 subjects – 4 papers
The application-oriented subjects shall be offered during the last two semesters of study viz., V and VI semesters. Examination shall be conducted in the subjects at the end of V & VI semesters.

**Group D:** field work/institutional training
Every student shall be required to undergo field work/institutional training, related to the application-oriented subject for a period of not less than 2 weeks, conveniently arranged during the course of 3rd year. The principal of the college and the head of the department shall issue a certificate to the effect that the student had satisfactorily undergone the field work/institutional training for the prescribed period.

**Diploma Programme:**
All the UG programmes shall offer compulsory diploma subjects and it shall be offered in four papers spread over each paper at the end of III, IV, V, & VI semesters.

e) **Co-Curricular activities: NSS/NCC/Physical education**
Every student shall participate compulsorily for period of not less than two years (4 semesters) in any one of the above programmes.

The above activities shall be conducted outside the regular working hours of the college. The principal shall furnish a certificate regarding the student’s performance in the respective field and shall grade the student in the five point scale as follows

- A-Exemplary
- B-very good
- C-good
- D-fair
- E-Satisfactory

This grading shall be incorporated in the mark sheet to be issued at the end of the appropriate semester (4th or 5th or 6th semester).
(Handicapped students who are unable to participate in any of the above activities shall be required to take a test in the theoretical aspects of any one of the above 3 field and be graded and certified accordingly).

4. **Requirement to appear for the examinations**
   a) A candidate will be permitted to appear for the university examinations for any semester if
      i) He/she secures not less than 75% of attendance in the number of working days during the semester.
      ii) He/she earns a progress certificate from the head of the institution, of having satisfactorily completed the course of study prescribed in the subjects as required by these regulations, and
      iii) His/her conduct has been satisfactory.

Provided that it shall be open to the syndicate, or any authority delegated with such powers by the syndicate, to grant exemption to a candidate who has failed to earn 75% of the attendance prescribed, for valid reasons, subject to usual conditions.

b) A candidate who has secured less than 65% but 55% and above attendance in any semester has to compensate the shortage in attendance in the subsequent semester besides, earning the required percentage of attendance in that semester and appear for both semester papers together at the end of the latter semester.

c) A candidate who has secured less than 55% of attendance in any semester will not be permitted to appear for the regular examinations and to continue the study in the subsequent semester. He/she has to rejoin the semester in which the attendance is less than 55%

d) A candidate who has secured less than 65% of attendance in the final semester has to compensate his/her attendance shortage in a manner as decided by the concerned head of the department after rejoining the same course.

5. **Restrictions to appear for the examinations**
   a) Any candidate having arrear paper(s) shall have the option to appear in any arrear paper along with the regular semester papers.

b) “Candidates who fail in any of the papers in Part I, II & III of UG degree examinations shall complete the paper concerned within 5 years form the date of admission to the said course, and should they fail to do so, they shall take the examination in the texts/revised syllabus prescribed for the immediate next batch of candidates. If there is no change in the texts/syllabus they shall appear for the examination in that paper with the syllabus in vogue until there is a change in the texts or syllabus. In the event of removal of that paper consequent to change of regulation and/or curriculum after 5 year period, the candidates shall have to take up an equivalent paper in the revised syllabus as suggested by the chairman and fulfill the requirements as per regulation/curriculum for the award of the degree.

6. **Medium of Instruction and examinations**
   The medium of instruction and examinations for the papers of Part I and II shall be the language concerned. For part III subjects other than modern languages, the medium of instruction shall be
either Tamil or English and the medium of examinations is in English/Tamil irrespective of the medium of instructions. For modern languages, the medium of instruction and examination will be in the languages concerned.

7. **Submission of Record Note Books for practical examinations**

Candidates appearing for practical examinations should submit bonafide Record Note Books prescribed for practical examinations, otherwise the candidates will not be permitted to appear for the practical examinations. However, in genuine cases where the students, who could not submit the record note books, they may be permitted to appear for the practical examinations, provided the concerned Head of the department from the institution of the candidate certified that the candidate has performed the experiments prescribed for the course. For such candidates who do not submit Record Books, zero (0) marks will be awarded for record note books.

8. **Passing Minimum**

a) A candidate who secures not less than 40% of the total marks in any subject including the Diploma and Foundation courses (theory or Practical) in the University examination shall be declared to have passed the examination in the subject (theory or Practical).

b) A candidate who passes the examination in all the subjects of Part I, II and III (including the Diploma and Foundation courses) shall be declared to have passed, the whole examination.

9. **Improvement of Marks in the subjects already passed**

Candidates desirous of improving the marks awarded in a passed subject in their first attempt shall reappear once within a period of subsequent two semesters. The improved marks shall be considered for classification but not for ranking. When there is no improvement, there shall not be any change in the original marks already awarded.

10. **Classification of Successful candidates**

a) A candidate who passes all the Part III examinations in the First attempt within a period of three years securing 75% and above in the aggregate of Part III marks shall be declared to have passed B.A/ B.Sc./B.Com./B.B.M. degree examination in **First Class with Distinctions**

b) (i) A candidate who passes all the examinations in Part I or Part II or Part III or Diploma securing not less than 60 per cent of total marks for concerned part shall be declared to have passed that part in **First Class**

   (ii) A candidate who passed all the examinations in Part I or Part II or Part III or Diploma securing not less than 50 per cent but below 60 per cent of total marks for concerned part shall be declared to have passed that part in **Second Class**

   (iii) All other successful candidates shall be declared to have passed the Part I or Part II or Part III or Diploma examination in **Third Class**

11. **Conferment of the Degree**

No candidate shall be eligible for conferment of the Degree unless he / she,

i. has undergone the prescribed course of study for a period of not less than six semesters in an institution approved by/affiliated to the University or has been exempted from the manner prescribed and has passed the examinations as have been prescribed therefor.

ii. Has satisfactory participates in either NSS or NCC or Physical Education as evidenced by a certificate issued by the Principal of the institution.
iii. Has successfully completed the prescribed Field Work/ Institutional Training as evidenced by certificate issued by the Principal of the College.

12. **Ranking**
A candidate who qualifies for the UG degree course passing all the examinations in the first attempt, within the minimum period prescribed for the course of study from the date of admission to the course and secures I or II class shall be eligible for ranking and such ranking will be confined to 10% of the total number of candidates qualified in that particular branch of study, subject to a maximum of 10 ranks.
The improved marks will not be taken into consideration for ranking.

13. **Additional Degree**
Any candidate who wishes to obtain an additional UG degree not involving any practical shall be permitted to do so and such candidate shall join a college in the III year of the course and he/she will be permitted to appear for par III alone by granting exemption form appearing Part I, Part II and common allied subjects (if any), already passed by the candidate. And a candidate desirous to obtain an additional UG degree involving practical shall be permitted to do so and such candidate shall join a college in the II year of the course and he/she be permitted to appear for Part III alone by granting exemption form appearing for Part I, Part II and the common allied subjects. If any, already passed. Such candidates should obtain exemption from the university by paying a fee of Rs.500/-.  

14. **Evening College**
The above regulations shall be applicable for candidates undergoing the respective courses in Evening Colleges also.

15. **Syllabus**
The syllabus for various subjects shall be clearly demarcated into five viable units in each paper/subject.

16. **Revision of Regulations and Curriculum**
The above Regulation and Scheme of Examinations will be in vogue without any change for a minimum period of three years from the date of approval of the Regulations. The University may revise/amend/change the Regulations and Scheme of Examinations, if found necessary.

17. **Transitory Provision**
Candidates who have undergone the Course of Study prior to the Academic Year 2007-2008 will be permitted to take the Examinations under those Regulations for a period of four years i.e. up to and inclusive of the Examination of April 2012 thereafter they will be permitted to take the Examination only under the Regulations in force at that time.
B. Sc. (MATHEMATICS with COMPUTER APPLICATIONS)  
WITH COMPULSORY DIPLOMA IN  
OPERATION RESEARCH  
(For the students admitted from the academic year 2007-2008 and onwards)  
Scheme of Examination

### First Year

<table>
<thead>
<tr>
<th>Semester</th>
<th>Part</th>
<th>Subject and Paper</th>
<th>Instruction hour/week</th>
<th>University Examination Duration In Hrs</th>
<th>Max. Marks</th>
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<tr>
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### Second Year

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<td>Gr.A Core XIII-Modern Algebra</td>
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<td>Gr.A Core XV Complex Analysis</td>
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<td>Gr.A Core XVI Internet &amp; Java</td>
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<td>Lab: Internet Java &amp; Visual Basic</td>
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**Allied subjects**

Any two subjects from the following
1. Physics
2. Chemistry
3. Accountancy

<table>
<thead>
<tr>
<th>Semester V</th>
<th>Application Oriented Subjects Paper I</th>
<th>Semester V I</th>
<th>Application Oriented Subjects Paper II</th>
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<tr>
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<td>Astronomy- I</td>
<td>Astronomy- II</td>
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<td>Numerical Methods-I</td>
<td>Numerical Methods-II</td>
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<td></td>
<td>Discrete Maths</td>
<td>Digital Electronics and Computer Fundamentals</td>
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<td></td>
<td>Graph Theory</td>
<td>Automata Theory &amp; Formal Languages</td>
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B.Sc (MATHEMATICS WITH COMPUTER APPLICATIONS)
Group A : Semester: I Core Paper –I

Subject title: Classical Algebra Credit hours-4

Subject Description: This course focuses on the convergence and divergence of different types of series also discusses the standard methods of solving both polynomial and transcendental type equations.

Goal: To enable the students to learn about the convergence and divergence of the series and to find the roots for the different types of the equation.

Objectives: On successful completion of this course the students should gain knowledge about the convergence of series and solving equations.

UNIT I:
Binomial, exponential theorems-their statements and proofs – their immediate application to summation and approximation only.

UNIT II:
Logarithmic series theorem-statement and proof-immediate application to summation and approximation only. Convergency and divergency of series -definitions, elementary results-comparison tests- De Alemberts and Cauchy’s tests.

UNIT III:
Absolute convergence-series of positive terms-Cauchy’s condensation test-Raabe’s test.

UNIT IV:
Theory of equations: Roots of an equation- Relations connecting the roots and coefficients-transformations of equations-character and position of roots-Descarte’s rule of signs-symmetric function of roots-Reciprocal equations.

UNIT V:
Multiple roots-Rolle’s theorem - position of real roots of f(x)=0 – Newton’s method of approximation to a root – Horner’s method.

Treatment as in

Reference:
Group A : Semester: I Core Paper –II

Subject title: CALCULUS

Credit hours-5

Subject description:
This course presents the idea of curvatures, integration of different types of functions, its geometrical applications, double, triple integrals and improper integrals.

Goal:
To enable the students to learn and gain knowledge about curvatures, integrations and its geometrical applications.

Objectives:
On successful completion of course the students should have gain about the evolutes and envelopes, different types of integrations, its geometrical application, proper and improper integration.

UNIT I:
Curvature-radius of curvature in Cartesian and polar forms-evolutes and envelopes-pedal equations-total differentiation-Euler’s theorem of homogeneous functions.

UNIT II:
Integration of $f'(x)/f(x)$,$f'(x)/\sqrt{f(x)}$,$(px+q)/\sqrt{(ax^2+bx+c)}$,$[\sqrt{(x-a)}/(b-x)]$,$[\sqrt{(x-a)(b-x)}]$,$1/\sqrt{(x-a)(b-x)}$,$1/(acos^2x+bsinx+c)$,$1/(acosx+bsinx+c)$, Integration by parts

UNIT III:
Reduction formulae-problems-evaluation of double and triple integrals-applications to calculations of areas and volumes-areas in polar coordinates.

UNIT IV:
Change of order of integration in double integral-Jacobions.- change of variables in double and triple integrals.

UNIT V:
Notion of improper integrals, their convergence, simple tests for convergence simple problems, Beta and Gamma Integrals-their properties, relation between them-evaluation of multiple integrals using Beta and Gamma functions.

Treatment as in

Reference:
Group A : Semester: II Core Paper –III

Subject title: ANALYTICAL GEOMETRY

Credit hours-4

Subject Description:
This course gives emphasis to enhance student knowledge in two dimensional and three dimensional analytical geometry. Particularly about two dimensional conic sections in polar coordinates and the geometrical aspects of three dimensional figs, viz, sphere, cone and cylinder.

Goal:
To enable the students to learn and visualize the fundamental ideas about co-ordinate geometry.

UNIT- I:

UNIT –II:
Analytical geometry of three dimensions:-Straight lines-Coplanarity of st.lines- Shortest distance (S.D) and Equation of S.D between two lines-simple problems.

UNIT –III:
SPHERE: Standard equation of sphere –results based on the properties of a sphere- Tangent plane to a sphere – Equations of a circle.

UNIT –IV:
CONE AND CYLINDER:- cone whose vertex is at the origen-envelopingcone of a sphere-right circular cone-equation of a cylinder-right circular cylinder.

UNIT –V:
CONICOIDs:-Nature of a conicoid-Standard equation of a central conicoid- Enveloping cone-Tangent plane – conditions for tangency –Director sphere and Director plane.

Treatment as in
1. Analytical Geometry by P.Durai Pandian & others.

Reference:
Group A: Semester: II Core Paper -IV

Subject title: MS-office & Lab Credit hours-5

Subject Description: This paper presents the overview of word processing, document creation and editing, keyword shortcuts, excel introduction, charts, problems in it, access introduction, database creation, table manipulations, reports, problems, power point overview, clipart, sounds, animation and application problems.

Goals: To enable the students to study about the word, document writing facilities, doing calculations using excel, database creation and manipulations over it using access & power point presentations.

Objectives:
On successful completion of the course the students should have:
- Learnt the document writing using word
- Learnt the calculations using excel
- Learnt the creation and manipulation of tables using access
- Learnt the power point slide shows.

UNIT I:
Microsoft Word: Word processing overview-creating and editing documents- formatting documents – working with header, footer and footnotes.

UNIT II:

UNIT III:
Microsoft Excel: Spreadsheet overview-creating worksheet-managing and analyzing complex worksheet –creating charts creating form template-sharing data between application.

UNIT IV:
Microsoft Access: Database overview-creating database-modifying table and creating form-filtering and querying tables-creating reports and mailing labels- sharing information between applications.

UNIT V:


REFERENCE BOOK:-
PRACTICAL LIST FOR MS-OFFICE

MS-Word
1. Illustrate the mail merge concept to apply for a suitable job for at least 5 companies.
2. Using MS-word perform the following:
   - Change the font size to 20
   - Change the font type to Garamond
   - Align the text to left, right, justify and center.
   - Underline the text.
   - Table manipulation.

MS-EXCEL
1. Built a worksheet to perform correlation and regression coefficient using formula and check the answer with built-in-functions.
3. Draw graphs to illustrate class performance.

MS-Power Point
4. Prepare an organization chart for a college environment in PowerPoint.
5. Perform frame movement by inserting clipart to illustrate running of a car automatically.
6. Prepare a Power Point presentation with all the slide translation facilities.

MS-Access
7. Perform sorting on name, place and pin code of students database and list them in the sorted order.
8. Using queries retrieve information from sales database which contains Trans-no, date, prod-id, prod-name qty, unit-price and region. List out records region wise, date-wise, product-wise.
   9. Create mailing labels for employee database.
Group A : Semester: III  Core Paper -VI

SUBJECT TITLE: Trigonometry, Vector Calculus and Fourier Series  Credit Hours: 4

UNIT –I:
Expansion of Cos nφ, Sin nφ, Cos^nφ, Sin^nφ– Hyperbolic functions – Separations of real and imaginary parts of Sin (α+iβ ), Cos (α +iβ ), Tan(α+iβ ), Sinh(α +iβ ), Cosh(α +iβ ), Tanh (α+iβ ), Tan^{-1} (α+iβ)

UNIT-II:
Logarithm of a complex number-Summation of trigonometric Series.

UNIT-III:
Scalar and vector point functions-Differentiation of vectors-Differential operators –Directional derivative, gradient, Divergence, Curl.

UNIT-IV:
Integration for vectors: Line, Surface and Volume integrals, Theorems of Gauss, Green, Stokes (Statements only) – Verifications.

UNIT-V:
Fourier Series: Definition – Finding Fourier coefficients for a given periodic function with period 2π-Odd and even functions – Half range series – change of interval.

Treatment as in ‘Trigonometry’ by Narayanan and T K M
Vector calculus by P.Duraipandian
Fourier series by S.Narayanan
Question paper setters to confine to the above text books only.

Reference:
Mathematics, Volume IV (Vector Calculus, Fourier Series) by P.Kandasamy, K.Thilagavathy
Publishers S.Chand & Company Ltd., Ramnagar, NEW DELHI-110 055.
Group A : Semester: III  Core Paper -VII
Subject Title: Mechanics  Credit Hours: 4

STATICS
UNIT I:

UNIT II:
Three forces acting on a rigid body – Coplanar Forces – Reduction of any number of Coplanar Forces – condition for a system of forces to reduce to a single force or a couple – Condition of equilibrium – Simple problems- Friction – Laws of friction – Co-efficient of friction cone and angle of friction – Simple problems.

DYNAMICS
UNIT III:
Projectile: Part of a projectile – Greatest height – Time of flight – Range on an inclined plane through the point of projection – Maximum range.

UNIT IV:

UNIT V:

Prescribed Text Book:
  Dynamics  Dr.M.K.Venkatararam, Agasthiar Book Publication, Trichy
  Statistics  Dr.M.K.Venkatararam, Agasthiar Book Publication, Trichy
Group A: Semester: III Core Paper -VIII

Subject Title: C Programming

Credit Hours: 4

Subject Description: This paper presents the importance of C language, its structure, Data types, Operators of C, Various control statements, Arrays, different types of functions and practical problems.

Goals: To enable the students to learn about the basic structure, Statements, arrays, functions and various concepts of C language.

Objectives:

On successful completion of the course the students should have:

- Learnt the basic structure, operators and statements of C language.
- Learnt the decision making statements and to solve the problems based on it.
- Learnt arrays, functions and solve the problems Regarding about it.

UNIT I:

Introduction – Importance of C Basic structure of c programme Character set- Constants – Keywords and identifiers – Variables Data types – Declaration of variables –Assigning values to variables –Defining symbolic constants.

UNIT II:


UNIT III:


UNIT IV:

One, Two dimensional arrays – Initiating two dimensional arrays – Multidimensional arrays –Declaring and initializing string variables –reading strings from terminal – Writing strings on the screen – Arithmetic operations on characters.

UNIT V:

Pointers- understanding pointers –Accessing the address of a variable – Declaring and initializing pointers – Accessing a variable through its pointers – pointer expressions – Pointer increments and scale factor – Pointers and arrays – Pointers and functions void printers.

TEXT BOOK:
REFERENCE BOOKS:
Ashok N. Kamthane “Programming with Ansi and Turbo C”, Pearson Education publishers, 2002
.ANSI C:

Diploma Course: Semester III

Subject title: Operations Research I

Credit hours: 3

Subject description:
This course contains advantages, limitations and applications of O.R, formulation of Linear Programming Problems (L.P.P), methods to solve L.P.P like simplex method, Charnes Penalty Method and Two Phase Simplex method. Also it deals about duality in L.P.P, Transportation and Assignment Problems with applications.

Goal:
It enables the students to use the mathematical knowledge in optimal use of resources.

Objectives:
On successful completion of this course students should have gained knowledge about optimal use of resources.

Unit I:

Unit II:
Simplex Method – Charnes Penalty Method (or) Big – M Method - Two Phase Simplex method – Problems.

Unit III:
Duality in L.P.P – Concept of duality – Duality and Simplex Method – Problems

Unit IV:
Unit V:  

References:

Group A: Semester: IV Core Paper–IX

Subject Title: Differential Equations and Laplace Transforms Credit Hours: 5

Subject Descriptions: This course presents the method of solving ordinary differential Equations of First Order and Second Order, Partial Differential equations. Also it deals with Laplace Transforms, its inverse and Application of Laplace Transform in solving First and Second Order Differential Equations with constant coefficients.

Goals: It enables the students to learn the method of solving Differential Equations.

Objectives: End of this course, the students should gain the knowledge about the method of solving Differential Equations. It also exposes Differential Equation as a powerful tool in solving problems in Physical and Social sciences.

Unit I:  
Ordinary Differential Equations: Equations of First Order and of Degree Higher than one – Solvable for $p$, $x$, $y$ – Clairaut’s Equation – Simultaneous Differential Equations with constant coefficients of the form
i) $f_1(D)x + g_1(D)y = \phi_1(t)$
ii) $f_2(D)x + g_2(D)y = \phi_2(t)$

where $f_1$, $g_1$, $f_2$ and $g_2$ are rational functions $D = \frac{d}{dt}$ with constant coefficients $\phi_1$ and $\phi_2$ explicit functions of $t$.

Unit II:  
Finding the solution of Second and Higher Order with constant coefficients with Right Hand Side is of the form $V e^{ax}$ where $V$ is a function of $x$ – Euler’s Homogeneous Linear Differential Equations – Method of variation of parameters.

Unit III:  
direct integration – Methods to solve the first order P.D. Equations in the standard forms – Lagrange’s Linear Equations.

**Unit IV:**
Laplace Transforms: Definition – Laplace Transforms of standard functions – Linearity property – Firsting Shifting Theorem – Transform of $tf(t)$, $\frac{f(t)}{t}$, $f'(t)$, $f''(t)$.

**Unit V:**
Inverse Laplace Transforms – Applications to solutions of First Order and Second Order Differential Equations with constant coefficients.

**Treatment as in**

**References:**
2) N.P. Bali, Differential Equations, Laxmi Publication Ltd, New Delhi, 2004

**Group A: Semester: IV Core Paper -X**

**Subject Title:** RDBMS AND ORACLE

**CREDIT HOURS:** 5

**Subject Description:**
This paper presents the basic concepts of DBMS, Keys, RDBMS, introduction to SQL, ORACLE data types, Queries in SQL, introduction to PL/SQL, its basic structure, triggers, basic concepts of forms, reports and practical problems.

**Goals:**
To enable the students to learn about the basic concepts of DBMS, RDBMS, SQL, PL/SQL, forms and Reports.

**Objectives:**
On successful completion of the course the students should have learnt the basic concepts of DBMS and RDBMS.
Learn to build a queries using SQL, PL/SQL.
Learn to design a forms and reports using ORACLE Developer 2000.

**UNIT –I:**

TEXT BOOKS:
For unit 1 treatment as in “Introduction to Database System” –Bipin Desai [chapter 1, sections 4.2 and 6.5.1 and 6.5.2]

UNIT II:
Integrative SQL –invoking SQL plus, data manipulation in DBMS ,The ORACLE data types, two dimention matrix creation, Intersection of data into tables, data constrains, computation in expression lists used to select data, logical operation, Range searching, pattern matching, Orac’e function, Grouping data from tables in SQL , Manipulating dates on SQL, joins, subqueries.

UNIT III:
PL/SQL-Introduction ,The PL/SQL execution enviroment, the PL/SQL syntax, Understanding the PL/SQL Block structure, database triggers.

UNIT IV:
Working with forms, Basic concepts, Application development in forms, Form module, Blocks items, Canvas view windows, Creating a form Generating and running a form, Using the Layout editor, Master form, Triggers, Data Navigation Via an Oracle form, Master detail form, Creating a master detail form, Master detail data entry screen.

UNIT V:
Working with reports ,Defining a data model for report, specific the layout of a report, use the Oracle reports interface, Creating a default tabular report, Creating computed columns, Creating user parameter, Arranging the layout, Creating a Master / Detail report, Creating a matrix report.

TEXT BOOK:
For units 2, 3, 4, 5, treatment as in ‘Commercial application Development using Oracle developer 2000’ by IVAN BAYROSS.

REFERENCE:
1. Alex Leen and Mathews Leon, “Database Management Systems” - Vikas publications
Group A:  Semester: IV  Core Paper –XI

Subject Title:  C++ PROGRAMMING  CREDIT HOURS: 5

Subject Description:
This paper presents the importance of object oriented language, drawbacks of procedure oriented programming, OOPs concepts, class structure, operators, the types of inheritance & polymorphism, Files, Streams and Exception handling & templates.

Goals:
To enable the students to learn about the basic OOPs concepts, class structure, operators, inheritance, polymorphism, files, Exception handling and Templates.

Objectives:
On successful completion of the course the students should have
- learnt the drawbacks of Pop and Need for OOP &OOPs concepts
- Learnt class structure, member functions & data members.
- Learnt the concept of inheritance, types and example problems.
- Learnt the concepts of polymorphism, types and problems.
- Learnt files, streams and Exception handling & Templates with practical problems.

UNIT-I:

UNIT-II:
Object oriented design – object oriented database – object oriented user interface – garbage collection and exception handling, Evolution of C++ - C verses C++ - C++ programming basics - data type - include directories – loops and decisions - structures - functions.

UNIT-III:

UNIT-IV:
UNIT-V:


Text Books:
1. E.Balagurusamy ‘Object Oriented programming with C++’, McGraw Hill

Reference Books:

SEMESTER IV : Lab CREDIT HOURS: 3

C PROGRAMMING PRACTICAL LIST:
1. Write a C program to generate ‘N’ Fibonacci number.
2. Write a C program to print all possible roots for a given quadratic equation.
3. Write a C program to calculate the statistical values of mean, median, mode, Standard Deviation and variance of the given data.
4. Write a C program to sort a set of numbers using the functions.
5. Write a C program to sort the given set of names and assign roll numbers.
6. Write a C program to search a required element in a list using binary search.
7. Write a C program to find factorial value of a given number ‘N’ using recursive function call.
8. Write a C program to find inverse and determinant of a given matrix.
9. Write a C program to find number of palindromes in a given sentence.
10. Write a C program to prepare pay list for a given data.
11. A file contains the name of students with their initials at the beginning. Write a program to read this file and write their names in another file with the initials at the end.
12. Convert a word star file into an ASCII file and store it another file.
C++ PROGRAMMING PRACTICAL LIST:
1. Create a class to implement the data structure STACK. Write a constructor to initialize the TOP of the stack to 0. Write a member function PUSH(). To insert an element and a member function POP() to delete an element. Check for overflow and underflow conditions.

2. Create a class ARITH which consists of a FLOAT and an INTEGER variable. Write member functions ADD(), SUB(), MUL(), DIV(), MOD() to perform addition, multiplication, division, and modulus respectively. Write member functions to get and display values.

3. Create a class which consist of employee detail ENO, ENAME, DEPT, BASIC SALARY. Write a member function to get and display them. Derive a class PAY from the above class and write a member function to calculate DA, HRA and PF depending on the grade and display the PAY Slip in a neat format using console I/O.

4. Define two classes polar and rectangle to represent points in the polar and rectangle system. Use conversion routines to convert from one system to another.

5. Create a class FLOAT that contains one float data member overload all the four arithmetic operators so that operate on the objects of FLOAT.

RDBMS PRACTICAL LIST:
1. Creating tables and writing simple queries using
   a) Comparison operators
   b) Logical Operators
   c) Set operators
   d) Sorting and Grouping
2. Writing Queries using built in functions
3. Creation of reports using column format
4. Updating and altering tables using SQL
5. Creation of students information table and write PL/SQL blocks find the total, average marks and results
6. Write a PL/SQL block to prepare the electricity bill
7. Write a PL/SQL to split the students information table in to two, one with the passed and other with failed
8. Write PL/SQL block to join two tables, first table contains the Roll no. and address.
9. Create a Database Trigger to check the data validity of record.
Diploma Course  Semester IV

Subject title: Operations Research II  Credit hours: 3

Subject Description:
This course gives emphasis to enhance student knowledge in game theory, performance measures of queues, optimal use of Inventory and Network scheduling with application.

Unit I:
Game Theory – Two person zero sum game – The Maxmini – Minimax principle – problems - Solution of 2 x 2 rectangular Games – Domination Property – (2 x n) and (m x 2) graphical method – Problems.

Unit II:
Queueing Theory – Introduction – Queueing system – Characteristics of Queueing system – symbols and Notation – Classifications of queues – Problems in (M/M/1) : (∞/FIFO); (M/M/1) : (N/FIFO); (M/M/C) : (∞/FIFO); (M/M/C) : (N/FIFO) Models.

Unit III:
Inventory control – Types of inventories – Inventory costs – EOQ Problem with no shortages – Production problem with no shortages – EOQ with shortages – Production problem with shortages – EOQ with price breaks.

Unit IV:

Unit V:
PERT – PERT calculations – Cost Analysis – Crashing the Network – Problems.

References:
Group A: Semester: V Core Paper –XII

Subject Title: Real Analysis Credit Hour: 5

Subject Description:
This course focuses on the Real and Complex number systems, set theory, point set topology and metric spaces.

Goal:
To introduce the concepts which provide a strong base to understand and analysis mathematics.

Objective:
On successful completion of this course the students should gain the knowledge about real and complex numbers, sets and metric space.

UNIT-I
Least upper bound, greatest lowest bound- the Cauchy schwwarz inequalities – Countable and uncountable sets- Uncountability of the real number systems- Set Algebra – Countable collections of countable sets.

Elements of point set topology: Euclidean space \( \mathbb{R}^n \) –open balls and open sets in \( \mathbb{R}^n \). The structure of open Sets in \( \mathbb{R}^n \) –closed sets and adherent points –The Bolzano –Weierstrass theorem – the Cantor intersection Theorem.

UNIT II
Covering –Lindelof covering theorem –the Heine Borel covering theorem –Compactness in \( \mathbb{R}^n \) –Metric Spaces –point set topology in metric spaces –compact subsets of a metric space – Boundary of a set.

UNIT III

UNIT IV
Definition of derivative –Derivative and continuity –Algebra of derivatives –Roll’s theorem –The mean value theorem for derivatives –Taylor’s formula with remainder. Properties of monotonic functions –functions of bounded variation –total Variation –additive properties of total variation on (a, x) as a function of \( x \) – functions of bounded variation expressed as the difference of increasing functions –continuous functions of bounded variation.
UNIT V


Treatment as in

References

Group A: Semester: V Core Paper –XIII

Subject title: Modern Algebra Credit hours: 5

Subject description:
This course provides knowledge about sets, mappings, different types of groups and rings.

Goals:
To enable the students to understand the concepts of sets, groups and rings. Also the mappings on sets, groups and rings.

Objective:
On successful completion of course the students should have concrete knowledge about the abstract thinking like sets, groups and rings by proving theorems.

UNIT I
Sets – mappings – Relations and binary operations – Groups: Abelian group, Symmetric group Definitions and Examples – Basic properties.

UNIT II

UNIT III
Homomorphisms – Cauchy’s theorem for Abelian groups – Sylow’s theorem for Abelian groups Automorphisms – Inner automorphism - Cayley’s theorem, permutation groups.

UNIT IV
Rings: Definition and Examples –Some Special Classes of Rings – Commutative ring – Field – Integral domain - Homomorphisms of Rings.
UNIT V

Ideals and Quotient Rings – More Ideals and Quotient Rings – Maximal ideal - The field of Quotients of an Integral Domain

Treatment as in
Unit I Chapter 1 Sections 1.1 to 1.3,
Chapter 2 Sections 2.1 to 2.3
Unit II Chapter 2 Sections 2.4 to 2.6
Unit III Chapter 2 Sections 2.7 to 2.10
Unit IV Chapter 3 Sections 3.1 to 3.3
Unit V Chapter 3 Sections 3.4 to 3.6.

References

Group A: Semester: V Core Paper –XIV

Subject Title: VISUAL BASIC Credit hours: 5
UNIT I:

UNIT II:
Branching and looping- logical operators – If-then,If-then-Else,Select case- For Next, Do loop. While-Wend, Stop-VB control functions – Forms and controls.

UNIT III:
Menus and dialog boxes: Bulinding Drop down menus, Accessing menu-sub menus- Popup menus- dialog boxes.
Executing and debugging a new project- Errors-Error handlers.

UNIT IV:
Procedures: Modulus and procedures- sub procedures-Event procedures-Function procedures.
Arrays : Characteristics-Declarations- Dynamic Arrays- Control arrays.

UNIT V:
Data Files: Characteristics-accessing and saving a file in VB –processing- Sequential Data file-
Random access file-Binary files.

Treatment as in Byron S Goutfield ,”VB” , schamn’s outlines , TMH Edition-2002

Application Oriented Subject-A
Group C: Semester: V

SUBJECT TITLE: ASTRONOMY – I CREDIT HOURS: 6

Subject Description: This course focuses on the Solar system, Celestial sphere, Dip-Twilight

Goal: To enable the students to understand the Astronomical aspects and about the laws governing the planet movements.

Objectives: On successful completion of this course the students should gain knowledge about Astronomy.

UNIT I:

UNIT II:
Celestial sphere – Celestial co–ordinates – Diurnal motion – Variation in length of the day.

UNIT III:
Dip – Twilight – Geocentric parallax.

UNIT IV:
Refration – Tangent formula – Cassinis formula.

UNIT V:
Kepler’s laws – Relation between true eccentric and mean anamolies. Treatment as in “ASTRONOMY” by S.Kumaravelu and Susheela Kumaravelu. Question paper setters to confine to the above text book only.
Application Oriented Subject-A  
Group C: Semester: V  

SUBJECT TITLE: Numerical Methods –I  
CREDIT HOURS: 6  

Subject Description: This course presents methods to solve linear algebraic and transcendental equations and system of linear equations. Also Interpolation by using finite difference formulae.  

Goal: It exposes the students to study numerical techniques as a powerful tool in scientific computing.  

Objective: On successful completion of this course the student gain the knowledge about solving the linear equations numerically and finding interpolation by using difference formulae.  

Unit I: The solution of numerical algebraic and transcendental Equations:  

Unit II: Solution of simultaneous linear algebraic equations:  

Unit III: Finite Differences:  

Unit IV: Interpolation (for equal intervals):  
Newton’s forward and backward formulae – equidistant terms with one or more missing values – Central differences and central difference table – Gauss forward and backward formulae – Stirlings formula.  

Unit V: Interpolation (for unequal intervals):  
Divided differences – Properties – Relations between divided differences and forward differences – Newton’s divided differences formula – Lagrange’s formula and inverse interpolation.  

Treatment as in  

References:  
Application Oriented Subject-A
Group C: Semester: V

Subject Title: DISCRETE MATHEMATICS Credit Hours: 6

Subject Description: This course focuses on the mathematical logic, Relations & Functions, Formal languages and Automata, Lattices and Boolean Algebra and Graph Theories.

Goal: To enable the students to learn about the interesting branches of Mathematics.

Objectives: On successful completion of this course should gain knowledge about the Formal languages Automata Theory, Lattices & Boolean Algebra and Graph Theory.

UNIT-I:

UNIT-II:
Relations and functions: Composition of relations, Composition of functions, Inverse functions, one-to-one, onto, one-to-one& onto, onto functions, Hashing functions, Permutation function, Growth of functions. Algebra structures: Semi groups, Free semi groups, Monoids, Groups, Cosets, Sets, Normal subgroups, Homomorphism. (2-3.5, 2-3.7, 2-4.2, 2-4.3, 2-4.6, 3-2, 3-5, 3-5.3, 3-5.4)

UNIT-III:
Formal languages and Automata: Regular expressions, Types of grammar, Regular grammar and finite state automata, Context free and sensitive grammars.(3-3.1, 3-3.2, 4-6.2)

UNIT-IV:
Lattices and Boolean algebra: Partial ordering, Poset, Lattices, Boolean algebra, Boolean functions, Theorems, Minimization of Boolean functions. (4-1.1, 4-2, 4-3, 4-4.2)

UNIT-V:
Graph Theories: Directed and undirected graphs, Paths, Reachability, Connectedness, Matric representation, Euler paths, Hamiltonian paths, Trees, Binary trees simple theorems, and applications. (5-1.1, 5-1.2, 5-1.3, 5-1.4)

Text Books:

Reference Books: 1. Discrete maths by N. C.h S. Iyengar and others
2. Discrete maths by J.K. Sharma
3. Graph theory for computer science and Engineers by Narsingh Deo
Application Oriented Subject-A  
Group C: Semester: V  
Credit Hours-6  

Subject Title: GRAPH THEORY  

Subject Description: This course focuses on the Graphs, Sub Graphs, Trees, Planar graphs, Directed graphs. It also deals about matrix representation of Graphs.  

Goal: To enable the students to understand the basic concepts of Graph Theory.  

Objectives: On successful completion of this course the students should gain knowledge about Graph Theory.  


UNIT II:  


UNIT IV: Planar graphs – Enter’s theorem on planar graphs – characterization of planar graphs (no proofs) of the difficult part of the characterization.  

UNIT V: Directed graphs – Connectivity – Entoiriom Digraphs – Tournaments. Treatment as in “A First Course in Graph Theory” by A.Chandran (Macmillan) Chapters 1 to 7.  

Books for References:  
1. Narasingh Deo, “Graph Theory” (Prentice Hall of India).  
Diploma Course: Semester V

Subject title: Operations Research -III  
Credit hours: 3

Subject Description:

This course presents applications and method to solve Integer Programming Problems, Non-linear Programming Problems and Dynamic Programming problems. It also includes Markov Analysis and Decision Analysis.

Unit I:
Integer Programming Problem – Gromory’s fractional cut Method – Branch Boud Method.

Unit II:

Unit III:

Unit IV:
Markov Analysis – Stochastic process – Markov analysis Algorithm.

Unit V:

References:
Group A: Semester: VI Core Paper –XV

Subject Title: Complex Analysis

Credit Hours: 5

Subject Description:
This course provides the knowledge about complex number system and complex functions.

Goal:
To enable the students to learn complex number system, complex function and complex integration.

Objectives:
On successful completion of this course the students should gained knowledge about the origin, properties and application of complex numbers and complex functions.

UNIT –I
Analytic function C-R equation – Sufficient condition – Harnomic functions.

UNIT-II
Biliner transformation – Cross Ratio – Fixed Points – Transformation which map real axis to real axis – Unit circle to unit circle – real axis to unit circle.

UNIT –III
Complex integration- Cauchy’s Integral Theorem – Cauchy’s Integral formula – Derivatives of analytic function – Moreras Theorem – Cauchy’s inequality – Liouville’s Theorem – Fundamental Theorem of Algebra.

UNIT-IV

UNIT-V

Prescribed Tex Book
“Complex Analysis” by Durai Pandian& Laxmi Durai Pandian - Emerald Publications.

References
Subject title:  INTERNET AND JAVA  

Credit hours: 5

Subject description:
This paper presents the introduction to internet, ISP, mail, web, URLs, schemes, browser, HTML, Usenet, Gopher, veronica, Jug head, Anonymous ftp, archie, telnet, talk, IRC and muds, Java introduction, data types, operators, statements, class, packages, interfaces, exception handling, threads, applets and AWTS.

Goals:
To enable the students to study about internet, mail, web, HTML, Usenet, Gopher, veronica, Jug head, Archie and Java fundamentals, class, packages, exception handling, threads, applets and AWTS.

Objectives:
On successful completion of the course the students should have:
Learnt the basic concept of internet, mailing, HTML, Archie, telnet, ftp and IRC muds.
Learnt about Java fundamentals, operators and statements.
Learnt the concept of packages, interfaces and exception handling.
Learnt the concept of threads, applets and AWTS.

UNIT I:
Introduction to Internet- Resources of Internet -hardware and software requirements of internet- Internet service providers (ISP)-Internet addressing- Mail Using mail from a shell account - Introduction to web- using the web.

UNIT II:
URLs, schemes host names and port numbers- Using the browser Hypertext and HTML- Using the web from a shell account Introduction to Usenet - Reading and posting Usenet articles- Using Usenet from a shell account- Gopher ,Veronica and Jug head- Using gopher from a shell account.

UNIT III:

UNIT IV:
Features of java - java environment - comparing java with C++ - introduction to java language -types - operators - flow control - classes - packages and interfaces.

UNIT V:
Java classes - string handling- exception handling - threads and synchronization - utilities - input / output - networking - applets - abstract windows toolkit (AWT)-imaging.

Text book:
Application Oriented Subject-B  
Group C: Semester: VI

Subject Title: ASTRONOMY II  
Credit Hours -6

Subject Description:  
This course focuses on the Time, Annual Parallax, Precession, Nutation and The Moon, Eclipses.

Goal: To enable the students to learn about the interesting facts of Moon, Sun Planetary Motion.

Objectives: On successful completion of this course the students should gain knowledge about Astronomy.

UNIT-I:  
Time: Equation of time – Conversion of time – Seasons – Calendar.

UNIT-II:  
Annual Parallax – Abberation.

UNIT-III:  
Precession – Nutation.

UNIT-IV:  
The Moon – Eclipses.

UNIT-V:  
Planetary Phenomenon – The Stellar system.

Treatment as in “ASTRONOMY” by Mr.S.Kumaravelu and Susheela Kumaravelu. 
Question paper setters to confine to the above text book only.
Application Oriented Subject-B  
Group C:  Semester: VI  

SUBJECT TITLE: NUMERICAL METHODS- II  
CREDIT HOURS: 6  

Subject Description: This course presents Numerical differentiation, Numerical integration and method to solve the differential equations. 

Goal: It exposes the students to study numerical techniques as powerful tool in scientific computing. 

Objective: On successful completion of this course the student gain the knowledge about solving the linear equations numerically and finding interpolation by using difference formulae. 

Unit I: Numerical differentiations:  
Newton’s forward and backward formulae to compute the derivatives – Derivative using Stirlings formulae – to find maxima and minima of the function given the tabular values. 

Unit II: Numerical Integration:  
Newton – Cote’s formula – Trapezoidal rule – Simpson’s 1/3rd and 3/8th rules – Gaiussian quadrature  
– two points and three points formulae 

Unit III: Difference Equation:  
Order and degree of a difference equation – solving homogeneous and non – homogeneous linear difference equations. 

Unit IV:  
Taylor series method – Euler’s method – improved and modified Euler method – Runge Kutta method(fourth order Runge Kutta method only) 

Unit V: Numerical solution of O.D.E(for first order only):  
Milne’s predictor corrector formulae – Adam-Bashforth predictor corrector formulae – solution of ordinary differential equations by finite difference method (for second order O.D.E). 

Treatment as in  
(Chapters: 9,10,11, Appendix and Appendix E). 

References:  
Application Oriented Subject-B  
Group C: Semester: VI

SUBJECT TITLE: DIGITAL ELECTRONICS AND COMPUTER FUNDAMENTALS
CREDIT HOURS: 6

UNIT-I
Representation of information Number System and Codes – Binary to Decimal Conversion - 
Code – Gray Code

UNIT-II
Logic circuits: Gates – AND, OR, NOT, NAND and NOR gates – Truth tables – Boolean 
Algebra – Karnaugh Maps – Product of sum and Sum of product methods – Don’t care conditions – 
Multiplexers and Demultiplexers – Flip flops – RS, JK, D, T flip flops – Decoders.

UNIT-III
Shift Registers – Counters – Arithmetic circuits – Half adder – Full Adder – Half & 

UNIT-IV
I/O devices: Punched tape – Tape readers – Alphanumeric codes – Character recognition – 
CRT – Output Device : Magnetic tape Output offline Operation – Error detecting and correcting 

UNIT-V
Semiconductor Memories: ROM – RAM – Static RAM, Dynamic RAM – Magnetic disc 
memories – Magnetic tape – Digital recording techniques

TEXT BOOK:
1. Digital Principles and Applications by Albert Malvino and Donald P Leach
2. Digital Computer fundamentals by T.C.Bartee.

REFERENCE:
Digital Circuits and Design by S. Salivaganan and S. Arivalagan.
Application Oriented Subject-B - Group C: Semester: VI
SUBJECT TITLE: AUTOMATA THEORY AND FORMAL LANGUAGES
CREDIT HOURS: 6

UNIT – I
Introduction – phrase structure languages.

UNIT – II
Closure operations.

UNIT – III
Context free languages.

UNIT – IV
Finite state automata.

UNIT – V
Push down automata.

Content and treatment as in, ‘Formal Languages and Automata’ by Rani Srimoney.
Revised edition 1984. Published by the Christian Literary Society, Madras-3
Chapters 1 to 6.
Reference Books:
1. Hopcroft and stillman - Formal languages and their relation automata -
   Addision Wesley.

DIPLOMA COURSE - SEMESTER –VI
SUBJECT TITLE: OPERATION RESEARCH -IV CREDIT HOURS: 3

PROJECT AND VIVA-VOCE:
PROJECT AREAS (BROAD FIELD)
1. Linear Programming Problems
2. Transportation Problems.
3. Assignment Problems
4. Inventory Control.
5. Queuing Models
6. PERT
7. Stochastic Process
8. Decision Analysis.

PROJECT : 75 MARKS
VIVA VOCE : 25 MARKS
TOTAL: 100 MARKS
SEMESTER-VI: LAB

CREDIT HOURS: 4

Internet Java Programming Practical List:

1. Create web pages using HTML to display ordered and unordered list of a departmental store.
2. Program to display image and text using HTML tag for a advertisement of a company product.
3. Create web pages for a business organization using HTML frames.
4. Create a web site of your department with minimum links using HTML.
5. Create a document using formatting and alignment tags in HTML.
6. Write a Java program to print the triangle of numbers.
7. Write a program which creates and displays a message on the windows.
8. Write a program to draw several shapes in the created window.
9. Write a Java program to accept values and find the given no. is even or odd.
10. Write a Java program to calculate standard deviation.

VISUAL BASIC LIST OF PRACTICALS

1. In VB, create a project that displays the current data and time. Use VB variable Now and the Format Library function.

Write a program

2. To enter and display text. Use text box and command button.
3. To convert temperature from Fahrenheit to centigrade or vice-versa
4. To select any one from a list. Use combo box to display choices.
5. To calculate factorial of a given number.
6. To illustrate the usage of Timer control.
7. To illustrate the usage of scroll bars.
8. To illustrate the usage of Drop down menus.
9. To illustrate the usage of menu enhancement.
10. To illustrate the usage of Pop-up menu.
11. To illustrate the usage of input boxes.
12. To find smallest of n numbers.
13. To find the sine of angle.
14. To sort list of numbers.
15. To determine deviations about an average.
(FOR CANDIDATES ADMITTED FROM 2007-2008)
BSc Degree Examination
First Semester

PART - III - Mathematics and Maths with CA

CLASSICAL ALGEBRA

Time: 3 hrs
Max. Marks: 100

SECTION A - (10 x 1 = 10 marks)

1. The coefficient of \( x^7 \) in \((1-x)^{-3}\) is ———

2. The coefficient of \( x^2 \) in the expansion of \( \frac{1+2x-3x^2}{e^x} \) is ———

3. Find the range in which \( \log (1+x) = x - \frac{x^2}{2} + \frac{x^3}{3} - \ldots \) is valid.

4. If \( \Sigma U_n \), \( \Sigma V_n \) are two series of positive terms and the second series is convergent, then find the condition for \( U_n \) and \( V_n \).

5. \( \lim_{n \to \infty} \left( \frac{U_n}{V_{n+1}} \right) = \frac{1}{2} \) then find \( V_n \).

6. The series \( \Sigma \frac{1}{n} \tan(\frac{n}{n}) \) is ———
   (a) Convergent  (b) Divergent  (c) Absolutely Convergent  (d) None.

7. If \( V + \sqrt{2} \) is a root of the equation \( x^4 - 14x^2 + 9 = 0 \) then other roots are ———

8. If \( a, b, c, d \) be the roots of the biquadratic equation
   \( x^4 + px^3 + qx^2 + rx + s = 0 \) then \( \frac{1}{a^2} = ———

9. Find the nature of the roots of the equation \( x^5 - 6x^2 - 4x + 5 = 0 \).
10. State the formula for Newton's method.

\[ \text{Section B} \ (5 \times 6 = 30 \text{ marks}) \]

11. (a) Show that \( \sqrt{x^2+16} - \sqrt{x^2+9} = \frac{1}{2x} \) nearly for sufficiently large values of \( x \).

\[ \text{Sum the Series} \ (\text{or}) \]

(b) \( \frac{5}{1} + \frac{7}{3!} + \frac{9}{5!} + \ldots \)

\[ \frac{5}{1} + \frac{7}{3!} + \frac{9}{5!} + \ldots \text{ series of terms} \]

12. (a) If \( a, b, c \) denote the three consecutive integers, show that \( \log b = \frac{1}{2} \log a + \frac{1}{2} \log c + \frac{1}{2a} + \frac{1}{3} (\frac{1}{2a} \log (2ac)) + \ldots \text{ series of terms} \)

(b) Find whether the series in which \( a_n = (n^3 + 1)^{1/2} \) are convergent or divergent.

\[ \sum_{n=1}^{\infty} \left( \frac{n^3 + 1}{n^6} \right)^{1/2} \text{ series of terms} \]

13. (a) Examine the convergence of the following series \( \sum_{n=1}^{\infty} \frac{(-1)^n}{n^p} \)

(b) Examine the convergence of the series \( \sum_{n=1}^{\infty} \left( \frac{n}{n+1} \right)^{1/2} \frac{1}{n^3} \)

14. (a) Solve the equation \( 21x^3 - 18x^2 - 36x + 8 = 0 \) whose roots are in H.P.

\( 21x^3 - 18x^2 - 36x + 8 = 0 \text{ series of terms} \)

(b) If the roots of \( x^3 + 3ax^2 + 3bx + c = 0 \) are in H.P then show that \( 2b^3 = c(3ab - c) \text{ series of terms} \).
15. (a) Solve the equation \( b x^5 + 11x^4 - 33x^3 - 33x^2 + 11x + 6 = 0 \)
\[ 
\text{Solutions: } 6x^5 + 11x^4 - 33x^3 - 33x^2 + 11x + 6 = 0
\]
(b) Increase by 7 the roots of the equation \( 3x^4 + 7x^3 - 15x^2 + x - 2 = 0 \)
\[ 
3x^4 + 7x^3 - 15x^2 + x - 2 \text{ into } \frac{3x^4 + 7x^3 - 15x^2 + x - 2}{7}
\]

\section*{SECTION C}

16. (a) Find the sum to infinity of the series
\[ 
\frac{1}{24} - \frac{1.3}{24} + \frac{1.3.5}{24.32.40} - ...
\]

(b) Sum the series
\[ 
\sum_{n=1}^{\infty} \frac{2}{n+2} \frac{3^n}{n^3} \frac{x^n}{n!}
\]

17. (a) State and prove Raabe's test

(b) Settle the range of values of \( x \) for which the following series convergent
\[ 
(i) \sum \frac{x^n}{1 + x^{2n}} \quad (ii) \sum \frac{x^n}{1 + x^{2n}}
\]

18. (a) Discuss the convergency of the following series
\[ 
(i) \sum \left( \frac{-1}{n^p} \right) \text{ when } 0 < p < 1 \quad (ii) \sum \frac{3^n}{n^p} \quad (iii) \sum \frac{1}{n(n \log n)^p}
\]

19. (a) Find the condition that the roots of the equation \( ax^3 + bx^2 + cx + d = 0 \) may be in G.P. Solve the equation
\[ 
27x^3 + 42x^2 - 28x - 8 = 0 \text{ whose roots are in G.P.}
\]

\[ 
ax^3 + bx^2 + cx + d = 0
\]
If \( a, b, c \) are the roots of \( x^3 + px^2 + qx + r = 0 \) form the

\[ x^3 + px^2 + qx + r = 0 \]

whose roots are \( \beta + \gamma - 2\alpha, \gamma + \alpha - 2\beta, \alpha + \beta - 2\gamma \).

\[ \beta + \gamma - 2\alpha, \gamma + \alpha - 2\beta, \alpha + \beta - 2\gamma \]

Statements can be verified and conclusions drawn.

60. (a) Show that the equation \( x^4 - 3x^3 + 4x^2 - 2x + 1 = 0 \) can be transformed

into reciprocal equation by diminishing the roots by unity.

Hence solve the equation.

\[ x^4 - 3x^3 + 4x^2 - 2x + 1 = 0 \]

(b) Solve the equation \( x^3 - 3x + 2 = 0 \) by Horner’s method.

\[ x^3 - 3x + 2 = 0 \]
First Semester
Calculus

Time: Three hours      Maximum Marks: 100 marks

Answer all questions

SECTION A (10 x 1 = 10 marks)

1. Find the radius of curvature \( x^2 + y^2 = 16 \) at \((1,1)\) is
\[ x^2 + y^2 = 16 \quad \Rightarrow \quad y = \sqrt{16 - x^2} \]
\[ \frac{dy}{dx} = -\frac{x}{\sqrt{16 - x^2}} \]
\[ \frac{d^2y}{dx^2} = \frac{64x}{(16 - x^2)^{3/2}} \]
\[ \rho = \frac{1}{\sqrt{1 + \left(\frac{dy}{dx}\right)^2}} \]
\[ \rho = \frac{1}{\sqrt{1 + \left(-\frac{x}{\sqrt{16 - x^2}}\right)^2}} \]
\[ \rho = \frac{1}{\sqrt{1 + \frac{x^2}{16 - x^2}}} \]
\[ \rho = \frac{1}{\sqrt{\frac{16}{16 - x^2}}} \]
\[ \rho = \frac{1}{\sqrt{\frac{16}{16}}} \]
\[ \rho = \frac{1}{4} \]

2. If \( U = x^3 + y^3 + y^2x \) then
\[ \frac{\partial U}{\partial x} + y \frac{\partial U}{\partial y} = \frac{3x^2 + 3y^2 + y}{2} \]

3. \[ \int \frac{dx}{2x+4} = \frac{1}{2} \ln |2x+4| + C \]
\[ \int \frac{dx}{2x+4} = \frac{1}{2} \ln |2x+4| + C \]

4. Evaluate \( \int \sin^4 x \, dx \)
\[ \int \sin^4 x \, dx = \frac{3}{8} \sin x - \frac{1}{4} \sin 3x + C \]

5. \( \int \frac{x^2}{x^4 + 1} \, dx = \frac{1}{2} \ln |x^4 + 1| + C \)

6. \[ \int \int xy \, dx \, dy \]
\[ \int \int xy \, dx \, dy = \frac{1}{2} \left( \frac{5}{1} \right) \]

7. \[ \int \int \int x \, dx \, dy \, dz \]
\[ \int \int \int x \, dx \, dy \, dz = \frac{1}{2} \left( \frac{3}{2} \right) \]

8. If \( u = x + y, \quad v = x - y \) then
\[ \frac{\partial (u, v)}{\partial (x, y)} = \frac{1}{2} \]
\[ u = x + y, \quad v = x - y \quad \Rightarrow \quad \frac{\partial (u, v)}{\partial (x, y)} = \frac{1}{2} \]

9. Evaluate \( \int_{0}^{\pi/2} \sin^3 \theta \cos \theta \, d\theta \)
\[ \int_{0}^{\pi/2} \sin^3 \theta \cos \theta \, d\theta = \frac{1}{4} \]

\[ \int_{0}^{\pi/2} \sin^3 \theta \cos \theta \, d\theta = \frac{1}{4} \]
\[ n \int_0^{\pi/2} \sin^3 \theta \cos \theta d\theta \]

10. \[ \left( \frac{\sqrt{5}}{2} \right) = \]

\[ \left( \frac{\sqrt{5}}{2} \right) = \]

SECTION B (5 x 6 = 30 marks)

11. (a) Find the radius of curvature of the parabola \( y^2 = 4ax \) at a point.

\( y^2 = 4ax \) \( x = \cos \theta \) \( y = \sin \theta \) \( d = \theta \)

(or)

(b) Find the \((p,r)\) equation the curve \( r^2 = a^2 \cos \theta \) and hence find the radius of curvature.

\( r^2 = a^2 \cos \theta \) \( x = \cos \theta \) \( y = \sin \theta \) \( d = \theta \)

12. (a) Evaluate \( \int \frac{2x}{\sqrt{x^2 + 5x + 6}} dx \)

\[ n \int \frac{2x}{\sqrt{x^2 + 5x + 6}} dx \]

(or)

(b) Evaluate (i) \( \int_a^\frac{\pi}{2} e^{-x^3} dx \) (ii) \( \int x \log(x+1) dx \)

\[ n \int \frac{2x}{\sqrt{x^2 + 5x + 6}} dx \]

13. (a) If \( I_n = \int_0^{\pi/2} x^n \cos x dx \) show that \( I_n + n(n-1)I_{n-2} = \left( \frac{\pi}{2} \right)^n \) and hence find \( \int_0^{\pi/2} x^3 \cos x dx \)

\[ I_n = \int_0^{\pi/2} x^n \cos x dx \] \( \hat{A} \hat{Q} \) \( \hat{P} \) \( \hat{Q} \) \( \hat{R} \) \( \hat{S} \) \( \hat{T} \) \( \hat{U} \) \( \hat{V} \)

(b) Find the area enclosed by the ellipse \( \frac{x^2}{a^2} + \frac{y^2}{b^2} = 1 \)

\[ \frac{x^2}{a^2} + \frac{y^2}{b^2} = 1 \]

14. (a) Change the order of integration in \( \int_0^a \int_y^{a-y} \frac{e^{-y}}{y} dx dy \) and evaluate it.

(or)
(b) If \((x+y+z=u, y+z=uvw)\) then find \(\frac{\partial(x, y, z)}{\partial(u, v, w)}\)

\((x+y+z=u, y+z=uvw)\) \(\frac{\partial(x, y, z)}{\partial(u, v, w)}\) \(\partial\).

15. (a) Discuss the convergence (i) \(\int_{-\infty}^{0} \frac{dx}{x^2}, a > 0\) (ii) \(\int_{-\infty}^{0} \frac{dx}{(1-3x)^2}\)

\(\mathrm{W}^{,\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\partial\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parte
18. (a) If \( \int_0^{\pi/2} \cos^3 x \cos nx dx = f(m,n) \) then \[ f(m,n) = \frac{m}{m+n} f(m-1,n-1) \] prove that hence prove that \( f(n,n) = \frac{\pi}{2^{n+1}} \). \[ \int_0^{\pi/2} \cos^3 x \cos nx dx = f(m,n) \] â™ f(m,n) = \( \frac{m}{m+n} f(m-1,n-1) \) â™ GÁ¾è. «ñ½âú
\[ f(n,n) = \frac{\pi}{2^{n+1}} \] â™ GÁ¾è.

(or)

(b) Find the area of the cardiod \( r=a(1+\cos \theta) \)
\[ r=a(1+\cos \theta) \] â¡ ø õ¬óõ¬÷ ܬìŠð´‹ ð° FJ¡ ðóŠ¹ è£‡è

19. (a) Compute \( \int_0^6 \frac{dx}{1+x^2} \) by Simpson’s rule taking six intervals.
\[ \int_0^6 \frac{dx}{1+x^2} \]
\[ \frac{\pi}{2} \]

(or)

(b) Evaluate \( \iiint xyz \) over the positive octant of the sphere \( x^2 + y^2 + z^2 = a^2 \) by transforming onto spherical coordinates.

20. (a) Prove that (i) \( \sqrt{(n+1)} = n!, n > 0 \) (ii) Evaluate \( \int_0^\infty e^{-x^2} \) dx
\[ \int_0^\infty e^{-x^2} \] dx

(i) GÁ¾è. \( \sqrt{(n+1)} = n!, n > 0 \) (ii) ñFŠ¬ôØJ™ è£‡è. \[ \int_0^\infty e^{-x^2} \]

(or)

(b) Prove that \( \beta(m,n) = \frac{\sqrt{(m)} \sqrt{(n)}}{\sqrt{(m+n)}} \)
\[ \frac{\sqrt{(m)} \sqrt{(n)}}{\sqrt{(m+n)}} \]

GÁ¾è. \( \beta(m,n) = \frac{\sqrt{(m)} \sqrt{(n)}}{\sqrt{(m+n)}} \)

SECTION –A (10X1=10 MARKS)

1. Write the equation of the Normal to the conic at ‘\( \alpha \)’
\[ ‘\alpha ‘ \] Å€’øðÔ ÜØÜ A‘Ç”Ö’Ç‡ë½„ëDì §ìëÉý $ÁýÅì ‘Ç† éÎ Ñ€ÒDì.

2. The polar equation of a conic is 
\[ l / r = 1 - e \cos \theta \] a) \( l / r = 1 + e \cos \theta \) b) \( l / r = 1 + e \Sin \theta \) c) \( l / r = 1 - e \Sin \theta \)

3. The angle between the straight line having the d.c’s \((l_1m_1n_1)\) and \((l_2m_2n_2)\) is
MathType 5.0 Equation

\[ a) \quad \cos \theta = \frac{l_1 l_2 + m_1 m_2 + n_1 n_2}{l_1 l_2 + m_1 m_2 + n_1 n_2} \]
\[ b) \quad \sin \theta = \frac{l_1 l_2 + m_1 m_2 + n_1 n_2}{l_1 l_2 + m_1 m_2 + n_1 n_2} \]
\[ c) \quad \cos \theta = \frac{l_1 l_2 + m_1 m_2 - n_1 n_2}{l_1 l_2 + m_1 m_2 + n_1 n_2} \]
\[ d) \quad \sin \theta = \frac{l_1 l_2 - m_1 m_2 + n_1 n_2}{l_1 l_2 + m_1 m_2 + n_1 n_2} \]

The lines \[ \frac{x-2}{4} = \frac{y-3}{3k} = \frac{z-4}{2k} \quad \text{and} \quad \frac{x-3}{2} = \frac{y-4}{-3} = \frac{z-7}{-3} \] are perpendicular. Find the value of \( K \).

5. Find the centre of the sphere \( 4x^2 + 4y^2 + 4z^2 - 8x + 1by + 24z + 45 = 0 \).

6. Find the equation of the sphere having \((1,-2,3)\) and \((3,-4,5)\) as ends of diameter.

7. If the cone \( ax^2 + by^2 + cz^2 + 2fyz + 2yzx + 2hxy + 24x + 2vy + 2wz = 0 \) has mutually perpendicular generators, then find the condition.

8. Write the equation of the right circular cylinder whose axis is the z axis and radius 'a'.

9. Write the general equation of the ellipsoid.

10. Write the general equation of the hyperboloid of the sheet.

SECTION –B (5X6=30 MARKS)

11.(a) Derive the equation of the asymptotes if the conic \( l/r = 1 + e \cos \theta \)

(b) Derive the polar equation of a curve in \( l/r = 1 + e \cos \theta \).

12.(a) Find the equation of the line through \((-1, 4,6)\) and parallel to the line \( x-y+2z=5, 3x+y+z=6 \).

(b) Obtain a symmetrical form of the equation \( 2x-2y-z=2, x+2y+2z=4 \) of a straight line.

13.(a) Find the equation of the sphere with centre \((1,2,3)\) and touch the plane \( x+2y+2z=1 \).
(or)
(b) Find the equation of the sphere passing through the points (2,0,1) (1,-5,1), (0,-2,3) & (4,-1,2).
(2,0,1) (1,-5,1), (0,-2,3) & (4,-1,2)±yE ÔûÇç,û ÁÆëìïøÔô §î,iÇôìëý ³ÁyÀîô°½î .în.

14.(a) Find the equation of the right circular cone whose vertex in the origin axis in the line x/1 = y/2 = z/3 and semi vertical angle is 30°.
-¾¢¨ÂÔõ ¯ ¡¸×õ x/1 = y/2 = z/3 ¬¾¢¨ÂÔõ ¯ ¼¨ÃÅð¼ §¸¡½õ 30° Ôôìë ôôìë ½ôìë ÚôÁéý ³ÁyÀîô°½î .în.
(or)
(b) Find the equation of the right circular cyclinder whose axis x-1/2 = y/3 = z-3/1 and radius 2.
'Ô §À±õôô ôôìë Çôëî «èî x-1/2 = y/3 = z-3/1
¬Àû 2 ±Êçç ôôìë Çôëî ³ÁyÀîô°½î .în.

15.(a) Find the director sphere of the conic coid (x²/a²) + (y²/b²) + (z²/c²) =1 (or)
(b) Tangent planes are drawn to (x²/a²) + (y²/b²) + (z²/c²) =1 through fixed point (α,β,υ). Prove that origin generate the cone. (αx+βy+υz)² = a² x² + b² y² + c² z²

SECTION-C (5X 12= 60)

16 (a) Derive the equation of the tangent at ‘α’ to the conic l/r = 1+e cosθ.
l/r = 1+e cosθ ±yE Ôôìë ¡ôêë ôôìë ‘α’ -ø ¡îïjî§,§¡ôêë ³ÁyÀîô°½ ôôìë Ôôìë çç.
(or)
(b) Find the equation of normal at ‘α’ on the conic l/r = 1+e cosθ.
l/r = 1+e cosθ ±yE Ôôìë ¡ôêë ôôìë ‘α’ -ø ¡îïjî§,§¡ôêë ³ÁyÀîô°½ ôôìë Ôôìë çç.

17 (a) Show that the line x-1/2 = y-2/-1 = z+6/ -3 and x+2y+z+2 =0, 4x+ 5y+3z+6=0 are coplanar and find the point of intersection and the plane of coplanarity.
x-1/2 = y-2/-1 = z+6/ -3 and x+2y+z+2 =0, 4x+ 5y+3z+6=0 ±yE pO §î,iü,û §Á ¾Çôìë ôôìë «ìôêôëìë ôôìë ³ÁyÀîô°½î .în.
(or)
(b) Find the length and the equation of the shortest distance between the lines x-3/-1 = y-4/2 = z+2/1 and x-1/1 = y+7/3 = z+2/2.
x-3/-1 = y-4/2 = z+2/1 and x-1/1 = y+7/3 = z+2/2 ÔûÇç,û ÁÆëìïøÔô §î,iÇôìëý ³ÁyÀîô°½î .în.

18 (a) Show that the plane 2x-2y+z+12 =0 touch the sphere
x² + y² + z² -2x-4y+2z-3=0 and find the point of contact.
2x-2y+z+12 =0 ±yE ¼Çôôìë x² + y² + z² -2x-4y+2z-3=0 ±yE ¾Çôìë ³âîë Íîë ³ÁyÀîô°½î .în.
(or)
(b) Obtain the equation of the sphere having the circle x² + y² + z² +10y-4z-8=0, x+y+z =3 as a great circle.
x² + y² + z² +10y-4z-8=0, x+y+z =3 ±yE ÀôìëôìëôêëÔôìë ¡ôêë ôôìë ôôìë ³ÁyÀîô°½î .în.

19(a) Find the equation of the cone whose vertex (x,y,z) which envelops the sphere
S ≡ x² + y² + z² -a² =0.
\[(x,y,z) \pm \delta \mathbf{O}_u \mathbf{C}_f \mathbf{e}^{-\mathbf{1}^i \mathbf{e} \mathbf{A}_i} \mathbf{j} \mathbf{i}, \mathbf{j}, \mathbf{i}^{1/4} S \equiv x^2 + y^2 + z^2 - a^2 = 0 \pm \delta \mathbf{S},\mathbf{i}^0 \mathbf{C}^3 \mathbf{H} \mathbf{A}_i \mathbf{j} \mathbf{k}, \mathbf{j}, \mathbf{i}^{1/4}.

(b) Find the equation of the right circular cylinder whose guiding curve in the circle \(x^2 + y^2 + z^2 = 4\), \(x + y + z = 2\).

\[(x^2 + y^2 + z^2 = 4, x + y + z = 2) \pm \delta \mathbf{E} \mathbf{A}^{1/4} \mathbf{e} \mathbf{A} \mathbf{A}_i \mathbf{j}, \mathbf{j}, \mathbf{i}^{1/4} - \mathbf{u} \mathbf{C} \mathbf{A}^{1/4} - \mathbf{O} \mathbf{C} \mathbf{e} \mathbf{y} \mathbf{A}^{1/4} \mathbf{A}_i \mathbf{j}, \mathbf{j}, \mathbf{i}^{1/4}.

20 (a) Find the locus of the point of intersection and three mutually perpendicular tangent plane to the central conic \(ax^2 + by^2 + cz^2 = 1\).

\[(ax^2 + by^2 + cz^2 = 1) \pm \delta \mathbf{E} \mathbf{A} \mathbf{A}_i \mathbf{j}, \mathbf{j}, \mathbf{i}^{1/4} - \mathbf{u} \mathbf{C} \mathbf{A}^{1/4} - \mathbf{O} \mathbf{C} \mathbf{e} \mathbf{y} \mathbf{A}^{1/4} \mathbf{A}_i \mathbf{j}, \mathbf{j}, \mathbf{i}^{1/4}.

(b) Find the equation of the tangent plane of the ellipsoid \((x^2 / 6 + y^2 / 3 + z^2 / 2) = 1\) which intersect in the line \(x/3 = y-3/3 = z/1\). Find also the co-ordinate of the point of contact.

\[x/3 = y-3/3 = z/1 \pm \delta \mathbf{E} \mathbf{A}^{1/4} \mathbf{e} \mathbf{A}_i \mathbf{j}, \mathbf{j}, \mathbf{i}^{1/4} - \mathbf{u} \mathbf{C} \mathbf{A}^{1/4} - \mathbf{O} \mathbf{C} \mathbf{e} \mathbf{y} \mathbf{A}^{1/4} \mathbf{A}_i \mathbf{j}, \mathbf{j}, \mathbf{i}^{1/4}.

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**TRIGONOMETRY AND VECTOR CALCULUS**

**Time: 3 Hrs**

**Maximum: 100 Marks**

**SECTION A (10X1=10 MARKS)**

1. Write the expansion of \(\cos n \theta\) \(\text{cosn} \theta - d\); tphpit vOJf.

2. Write the expansion of \(\sin n \theta\) \(\text{sin} \theta - d\); tphpit vOJf.

3. \(\log i =\text{Log i} =\log \delta\) \(\text{Log} \delta\) fhz;f.

4. Find \(\log(-e)\) \(\text{Log(-e)}\) fhz;f.

5. A function F is said to be harmonic if

   \((a) \ \nabla F = 0\) \((b) \ \nabla \times F = 0\) \((c) \ \nabla^2 F = 0\) \((d) \ \Delta F = 0\)

\(\text{F rhHG ,irr;rhHghf ,Uf;f Ntz;Lkhapd;\)}

\((m) \ \nabla F = 0 \ \text{F} = 0 \ \text{F} = 0 \ \Delta F = 0\)

6. Find the value of \(\text{div (curl F)}\).

\(\text{div (curl F)} - d; \text{kJpg;G fhz;f.}\)

7. Write the formula for work done by the force of a vector F F ntf;IH vd;w tpirapdhy; nra;ag;gLk; Ntiryf;fhd thag;g;ghl;bid vOJf.

8. F is called conservation field is

   \((a) \ F = \nabla \phi \) \((b) \ F = \nabla \phi \) \((c) \ F = \nabla \phi \) \((d) \ F = \nabla \phi \) \nabla F = 0

\(F \text{vd;gJ tUp pf;fg;gl;f skhlf ,Uf;f Ntz;Lkhapd;\)}

\((m) \ F = \nabla \phi \) \((M) \ F = \nabla \phi \) \(\nabla \phi \) \(\Delta F = 0\)

9. If \(f(x) = e^x\) then find the value of \(a_0\) in \([0, 2\pi]\)

\(f(x) = e^x \text{vdpy; } [0, 2\pi] - y; a_0 - d; \text{kJpg;G fhz;f.}\)

10. The period which is valid for writing half range series is
(a) 0 (b) $2\pi$ (c) $\pi$ (d) None of these.

SECTION –B (5X6=30)

11. (a) Express $\sin 5\theta$ in terms of $\sin \theta$.

(m) $\sin 5\theta = \sin \theta - 10\sin^3 \theta + 5\sin^5 \theta$.

(or)

(b) If $\tan \theta / \theta = 2524 / 2523$. Show that $\theta$ is approximately equal to $1^0 58'$.

(M) $\tan \theta / \theta = 2524 / 2523$ and $\theta = 1^0 58'$.

12. (a) Express $(-2)^i$ in $a+ib$ form.

(m) $(-2)^i = a+ib$.

(or)

(b) S.T $\log (1 + e^{ix}) = \log (2 \cos \theta/2) + i \theta/2$.

(M) $\log (1 + e^{ix}) = \log (2 \cos \theta/2) + i \theta/2$.

13. (a) Prove that $\text{div}(\text{grad} F) = \nabla^2 F$.

(m) $\text{div}(\text{grad} F) = \nabla^2 F$.

(or)

(b) P.T. $\text{curl} (\phi f) = \phi (\nabla \times f) + (\nabla \phi) \times f$.

(M) $\text{curl} (\phi f) = \phi (\nabla \times f) + (\nabla \phi) \times f$.

14. (a) Obtain $\int A \, dr$ whose $A = z\text{i} + x\text{j} + yt$ and $C$ is the arc of the curve $r = \cos t + \sin t + tk$ from $t=0$ to $t=2\pi$.

(m) $\int A \, dr = a + ib$.

(or)

(b) Find the work done by the force $F = 3x^2 \text{i} + 2yz \text{j} - z^2 \text{k}$ in moving a particle along the curve $x=2t$, $y=t^2$ and $z=t$ from $t=0$ to $t=2$.

(M) $t=0$ to $t=2$.

15 (a) Obtain the Fourier series for $f(x) = x$, $-\pi < x < \pi$.

(m) $f(x) = x$, $-\pi < x < \pi$.

(or)

(b) Obtain the half range Cosine series for $f(x) = x$ in $0 < x < \pi$.

(M) $0 < x < \pi$.

SECTION C (5X12=60)

16 (a) Prove that $2^6 \cos^7 \theta = \cos 7\theta + 7 \cos 5\theta + 21 \cos 3\theta + 35 \cos \theta$.

(m) $2^6 \cos^7 \theta = \cos 7\theta + 7 \cos 5\theta + 21 \cos 3\theta + 35 \cos \theta$.

(or)

(b) Expand $\cos^4 \theta \sin^3 \theta$.

(M) $\cos^4 \theta \sin^3 \theta = \text{integral}$.

17 (a) Sum the series $\sin \alpha + \sin (\alpha + \beta) + \sin (\alpha + 2\beta) + \ldots$ to $n$ terms.

(m) $\sin \alpha + \sin (\alpha + \beta) + \sin (\alpha + 2\beta) + \ldots$ to $n$ terms.

(or)
(b) Sum to infinity the series : 
\[ 1 + e^{2\cos2\theta/2!} + e^{4\cos4\theta/4!} + \ldots \approx \]

\[ 1 + e^{2\cos2\theta/2!} + e^{4\cos4\theta/4!} + \ldots \approx \]

18 (a) Prove that
\[ \nabla X(\nabla Xf) = \nabla (\nabla f) - \nabla^2 f. \]

(m) \[ \nabla X(\nabla Xf) = \nabla (\nabla f) - \nabla^2 f \text{ epWTf.} \]

(or)

(b) P.T
\[ F = (3x^2 + 2y^2 +1)i + (4xy-3y^2z-3)j + (z-y^3)k \text{ vd epWTf.} \]

(M) \[ F = (3x^2 + 2y^2 +1)i + (4xy-3y^2z-3)j + (z-y^3)k \text{ vd ntf; lH Royw; W vd epWTf.} \]

19. (a) Using Gauss theorem find the value of \[ \int F \cdot n \text{ ds.} \]
Where \[ F = xy^2i + yz^2j + zx^2k \] and \[ S \] is the closed surface banded by the planes \[ x=0, x=1, y=0, y=2 z=0 \& z=3. \]

(m) \[ \int F \cdot n \text{ ds} \]
\[ F = xy^2i + yz^2j + zx^2k, S \]
\[ \text{vd;gJ} x=0, x=1, y=0, y=2 z=0 \& z=3 \text{ vd;w jsq;fshy; %lg;gl;l Nkw;gug;G.} \]

(or)

(b) Evaluate \[ \int f \text{ dv} \]
for the vector \[ f = xi + yj + zk \]
whose \[ V \] is the regions bounded by the surface \[ x=0, x=2, y=0, y=6, z=4 \& z= x^2. \]

(M) \[ \int f \text{ dv} \]
\[ kjpg;G fhz;f. ,q;F \text{ vd;gJ Mfpa jsq;fs; milgLk; gFjpahFk;}. \]

20. (a) Obtain the Fourier series for \[ f(x) = x^2 \]
where \[ -\pi < x < \pi \] and deduce that
\[ 1/ 1^2 + 1/ 2^2 + 1/ 3^2 + \ldots = \pi^2 / 6. \]

(m) \[ -\pi < x < \pi \text{ vd;w } ,ilntspapy; \]
\[ f(x) = x^2 \text{ vd;w rhHgpd; G+hpaH njhliuf; fhz;f.} \]
\[ mjypUe;J 1/ 1^2 + 1/ 2^2 + 1/ 3^2 + \ldots = \pi^2 / 6. \text{ vd epWTf.} \]

(or)

(b) If \[ f(x) = -x \text{ if } -\pi < x < 0 \]
\[ x \text{ if } 0 \leq x \leq \pi \]
Expand \[ f(x) \] as a Fourier series in the interval \( (-\pi, \pi) \).
MECHANICS

Time : 3 hours       Maximum : 100 Marks

SECTION –A (10 x 1 = 10 Marks)
Answer all questions.
1. If forces acting at a point are in equilibrium their resultant is ----------
2. Find the resultant of lines equal forces p acting at a point inclined at an angle \(\pi/2\)
3. If \(x=0, y=0\) and \(G \neq 0\) then the system will reduce to a ----------.
4. If the angle of friction is 30\(^{\circ}\) then find \(\mu\).
5. Find the time of flight of projectile.
6. The latus reaction of the projectile is...........
7. Find the Pedal equation of the central orbit.
8. The oval velocity in a central orbit about the central truck is ............
9. The period of a S.H.M is .............
10. The impulse of a free F during time T is .............

SECTION – B (5 X 6 = 30 MARKS)
11. a. Find the resultant of any number of Coplanar forces acting at a point.
12. a. Prove that if three coplanar forces acting on a rigid body keep it in equilibrium they

(or)

b. P and Q are two like parallel forces acting at A and B respectively. Prove that is they
interchange positioning the point of application of the resultant is displacement through a
distance P-Q/P+Q. AB along AB.

b. A uniform ladder is in equilibrium with one and rusting on the ground and the other
against a vertical wall if the ground and the wall be both rough, the coefficient of friction
being \(\mu\) and \(\mu'\) respectively and if the ladder be on the point of slipping at both ends. Shows
that O the inclination of the ladder to the horizon is given by \(\tan \theta = 1 - \mu' / 2\mu\).
13. a. Obtain the great height attained by a projectile.

b. If the greatest height attained by the particle is a quarter of its range on the horizontal plane through the point of projection, find the angle of projection.

14. a. A particle describes in equiangular spiral \( r = ae^{\theta} \cot \alpha \) under the action of the force to the pole. Find the law of force.

b. A particle moves in a path given by \( r = ae^{\theta} \) with no force in the line joining the particle to the pole. Show that the angular velocity about the pole is constant and the speed varies as its distance from the pole.

15. a. If the displacement of a moving point at any time be given by an equation of the form \( x = a \cos \omega t \sin \omega t \) show that the motion is a S.H.M find its period.

b. A smooth sphere impinges obliguously on a fixed smooth plane find the loss in K.E of the sphere.

SECTION C (5 X 12 = 60 MARKS)

16. a. State and prove Lami’s theorem.

b. Find the resultant of two like parallel forces. Also finds its position.

17. a. Obtain the necessary and sufficient condition that a system of Coplanr forces acting and rigid body may be in equilibrium.

b. A body is at rest on a rough plane inclined to the horizon at an angle greater than the angle of friction and is acted upon a force parallel to the plane and along the line of greatest slope, then show that p lies between \( W\sin(\alpha - \lambda) / \cos \lambda \) and \( W\sin(\alpha + \lambda) / \cos \lambda \).
18. a. Prove that the path of a projectile is a parabola.

(b) A particle is projected with a velocity $2ag$, so that it just clears two walls of equal height 'a' at a distance of '2a' apart. Show that the latus rectum of the path is '2a' and the time of passing the wall is $\frac{2(a/g)}{\cos \lambda}$ seconds.

19. a. Derive the differential equation of central orbit in polar coordinates.

(b) A particle describes on an elliptic orbit under a central force towards a focus. If $\upsilon_1$, $\upsilon_2$, and $\upsilon_3$ be the speeds at the ends of the minor and major axes. Show that $\upsilon_2^2 = \upsilon_1 \upsilon_3$.

20. a. In a S.H.M if $f$ be the acceleration and $\upsilon$ the velocity at any time and $T$ is the periodic time, prove that $f^2T^2 + 4 \pi^2 \upsilon^2$ is a constant.

(b) Show that the resultant of the single harmonic motions of same period along the same straight line is also a simple harmonic motion with same period.

DIFFERENTIAL EQUATIONS AND LAPLACE TRANSFORMS

Time: 3 Hrs       Maximum: 100 Marks

SECTION –A (10X1=10 MARKS)
ANSWER ALL QUESTIONS

1. Find the general solution of \( y - px = a/p \).
   \( y - px = a/p - d \); nghJ jPHit fhz;f.
2. Find the solution of \( p^2 - 4p - 12 = 0 \)
   \( p^2 - 4p - 12 = 0 \); vd; wrk; ghld; bd; jPHT fhz;f.
3. Find the solution \( (D^3 - D) y = 0 \)
   \( (D^3 - D) y = 0 \); d; jPHT fhz;f.
4. If \( x^2 = 1 + p^2 \) then find \( 1/p \).
   \( x^2 = 1 + p^2 \); vdpy; \( 1/p \) fhz;f.
5. The elimination of arbitrary constants \( h,k \) from \( (x-h)^2 + (y-k)^2 + z^2 = a^2 \) is
   \( (x-h)^2 + (y-k)^2 + z^2 = a^2 \); vd; ghld; hjwphpia ePf; fp fpilg; gJ
6. Find the auxillary equation of \( Pp + Qq = R \)
   \( Pp + Qq = R \); vd; gjpd; Jiz rkd; ghld; ilf; fhz;f.
7. \( L \{ e^{-at} \} = \)
   \( L \{ e^{-at} \} = \)
8. \( L \{ t e^t \} = \)
   \( L \{ t e^t \} = \)
9. Find \( L^{-1} \left( \frac{1}{S^2} \right) \)
   \( L^{-1} \left( \frac{1}{S^2} \right) \); apidf; fhz;f.
10. Find \( L^{-1} \left( \frac{S}{S^2 + 9} \right) \)
    \( L^{-1} \left( \frac{S}{S^2 + 9} \right) \); apidf; fhz;f.

SECTION-B ( 5X6= 30)

11. (a) Solve : \( p^2 - 5p + 6 = 0, \ p = dy/dx. \)
    (m) jPHi; f : \( p^2 - 5p + 6 = 0, \ p = dy/dx. \)
    (or)
    (b) Solve : \( dx / z(x+y) = dy / z(x-y) = dz / x^2 + y^2. \)
    (M) jPHi; f : \( dx / z(x+y) = dy / z(x-y) = dz / x^2 + y^2. \)
12. (a) Solve \( (D^2 - 4D + 13)y = e^{2x} \cos 3x. \) (or)
    (m) jPHi; f : \( (D^2 - 4D + 13)y = e^{2x} \cos 3x. \)
    (or)
    (b) Find the particular integral of \( (D^2 + 5D + 6)y = x^2 e^{-x}. \)
    (M) \( (D^2 + 5D + 6)y = x^2 e^{-x} - d; \) rpwg; G njhf fhz;f.
13. (a) Form the partial differential equation by eliminating \( a \) and \( b \) from \( (x-a)^2 + (y-b)^2 + z^2 = 1. \) (or)
    (m) \( (x-a)^2 + (y-b)^2 + z^2 = 1 \); ypUe; J a kw; Wk; b Mfpatw; iw ePf; Ftjd; %yk; gFjp tiff; nfO rkd; ghld; il cUthf; Ff.
    (or)
    (b) Solve : \( q - p + x - y = 0 \)
    (M) jPHi; f : \( q - p + x - y = 0 \)
14. (a) Find \( L(Sin 3t Sin 2t) \) (or)
    (m) \( L(Sin 3t Sin 2t) - iaf; \) fhz;f.
15. (a) Find $L^{-1} \left[ \frac{1}{S(S+3)} \right]$ (or) $L^{-1} \left[ \frac{1}{S(S+3)} \right] = \text{if} \; \text{fhz;f}.$

(b) Find $L^{-1} \left[ \frac{S}{(S+2)^2} \right]$ (M) $L^{-1} \left[ \frac{S}{(S+2)^2} \right] = \text{if} \; \text{fhz;f}.$

SECTION – C (5X12 =60)

16. (a) Solve $(dx/dt) + 4x + 3y = t$, $(dy/dt) + 2x + 5y = e^t$ (or) $(dx/dt) + 4x + 3y = t$, $(dy/dt) + 2x + 5y = e^t$.

(b) Solve $p^3 - 4xyz + 8y^2 = 0$. (M) $p^3 - 4xyz + 8y^2 = 0$.

17. (a) Solve $x^2 (d^2y / dx^2) - 3x (dy/dx) + 5y = x^2 \sin (\log x)$ (or) $x^2 (d^2y / dx^2) - 3x (dy/dx) + 5y = x^2 \sin (\log x)$.

(b) Solve $(D^3 - 3D^2 + 3D - 1)y = e^{-x} x^2$. (M) $(D^3 - 3D^2 + 3D - 1)y = e^{-x} x^2$.

18. (a) Solve $z = px + qy + \sqrt{1+p^2 + q^2}$. (or)

(b) Solve $9(p^2 z + q^2) = 4$. (M) $9(p^2 z + q^2) = 4$.

19. (a) If $L\{ f(t) \} = f(s)$ then prove that $L \{ t^n f(t) \} = (-1)^n \frac{d^n}{ds^n} [f(s)]$. (or) $L \{ t^n f(t) \} = (-1)^n \frac{d^n}{ds^n} [f(s)] \; \text{vh} \; \text{epWTf}.$

(b) Evaluate:

(i) $L \{ t^2 \cos 3t \}$

(ii) $L \{ t^2 \ e^t \ \sin t \}$ (M) $L \{ t^2 \cos 3t \}$

(i) $L \{ t^2 \cos 3t \}$

(ii) $L \{ t^2 \ e^t \ \sin t \}$

20. (a) Using Laplace transform : Solve $(D^2 + 4D + 13)y = 2 e^{-x}$ given that $y(0) = 0$, $y'(0) = -1$ (or)

(m) $yhg;yh]; \ cUkhw;wj;ij \ \text{gad;gLj;jp} \ jPHf;f : (D^2 + 4D + 13)y = 2 e^{-x} \ NkYk; \ y(0) = 0, y'(0) = -1.$

(b) Using Laplace transform, Solve : $(d^2y/ dx^2) - 3(dy/dx) + 2y = 4$, $y(0) = 2$, $y'(0) = 3$. (M) $yhg;yh]; \ cUkhw;wj;ij \ \text{gad;gLj;jp} \ jPHf;f : (d^2y/ dx^2) - 3(dy/dx) + 2y = 4$, $y(0) = 2$, $y'(0) = 3$. 


Section – A  
(10 X 1 = 10 )

1. If A and B are countable sets, then AUB is __________.
   \( A, B \subseteq \mathbb{N} \implies \mathbb{N} \subseteq A \cup B \)

2. The set of all irrational numbers is __________.
   \( \mathbb{Q}^C \)

3. If \( x, y \in \mathbb{R}^n \) then \( |x.y| \) ________ \( |x| \cdot |y| \)
   \( x, y \in \mathbb{R}^n \implies |x.y| \leq |x| \cdot |y| \)

4. \( S = \{ \frac{1}{n} : n = 1, 2, \ldots \} \) has___________ an accumulation point.
   \( S = \{ \frac{1}{n} : n = 1, 2, \ldots \} \) has countably many accumulation points.

5. Write the condition for \( d(x, y) = 0 \), in a metric space.
   \( d(x, y) = 0 \implies x = y \)

6. Every ball \( B_m(a, r) \) in a metric space \( m \) is __________.
   \( B_m(a, r) \)

7. If \( f \) is monotonic \( m[a,b] \), then \( f \) is of ________ \( m[a,b] \)
   \( f \) is monotonic \( a \leq x \leq b \implies f(a) \leq f(b) \)

8. \( V_f(a,b) = \) ________.
   \( V_f(a,b) = \) ________.

Section – B  
(5 X 6 = 30 )

9. If \( a < b \) then find the value of \( \int_{a}^{b} f(x) \, dx \)
   \( a < b \implies \int_{a}^{b} f(x) \, dx = \int_{a}^{b} f(x) \, dx \)

10. In Riemann – Stieltjes integral, a remarkable connection exists between the integral and the ________.
    \( \int_{a}^{b} f(x) \, d\alpha(x) = \int_{a}^{b} f(x) \, d\alpha(x) \)

11.(a) Prove that the every subset of a countable set is countable.
    \( A \subseteq \mathbb{N} \implies A \subseteq \mathbb{N} \)

(b) Prove the set of Q of all rational numbers is a countable set.
    \( \mathbb{Q} \)

12.(a) State and prove Lindelof covering Theorem.
    \( A \subseteq \mathbb{R} \implies \mathbb{R} \subseteq A \)

(b) Show that a closed subset of a metric space in compact.
    \( A \subseteq \mathbb{R} \implies \mathbb{R} \subseteq A \)

13.(a) \( f = s \rightarrow T \) and \( x \subseteq S, y \subseteq T \). Prove that
    (i) \( x = f^{-1}(y) \implies f(x) \subseteq y \)
(ii) \( y = f(x) \Rightarrow x \subseteq f^{-1}(y) \)
\( f = \mu \rightarrow T \) µùöô. §ÁÔō \( x \subseteq S, y \subseteq T \) ±Éöô
(i) \( x = f^{-1}(y) \Rightarrow f(x) \subseteq y \)
(ii) \( y = f(x) \Rightarrow x \subseteq f^{-1}(y) \)
\( \pmÉ¿ÁÓš. \)

(b) State and Prove Boljano’s theorem.
\( [\underbrace{\underbrace{\underbrace{\underbrace{A}}_{\alpha}}_{\beta}}_{\gamma}] \subseteq \pmÉ¿ÁÓš. \)

14.(a) If \( f \) and \( g \) are bounded variation on \([a,b]\) show that \( V_{f,g} \leq AV_f + BV_g \) where
\( A = \sup \{ |g(x)| : x \in [a,b] \} \quad B = \sup \{ |f(x)| : x \in [a,b] \} \)
\( [a,b] \) - ø \( f, g \) ±É¿ÁÓš. \( V_{f,g} \leq AV_f + BV_g \) ±Éì ø, ¶Í. ¡ø ¡ø
\( A = [\underbrace{\underbrace{\underbrace{\underbrace{A}}_{\alpha}}_{\beta}}_{\gamma}] \subseteq \pmÉ¿ÁÓš. \)
\( B = [\underbrace{\underbrace{\underbrace{\underbrace{A}}_{\alpha}}_{\beta}}_{\gamma}] \subseteq \pmÉ¿ÁÓš. \)

(b) Define bounded variation and total variation of \( f \) on \([a,b]\).
\( [a,b] - ø f - ÁÁÅé\( \gamma\) \( A_{\overline{\alpha}} \overline{E}_0 \) ÁÁÜô \( [A_{\overline{\alpha}} \overline{E}_0] \). \)

15.(a) If \( \int_a^c f(x) \, dx + \int_c^b f(x) \, dx \) exist for \( c \in (a,b) \) Prove that
\( \int_a^c f(x) \, dx + \int_c^b f(x) \, dx = \int_a^b f(x) \, dx \)
\( c \in (a,b) - ø \int_a^c f(x) \, dx + \int_c^b f(x) \, dx = \int_a^b f(x) \, dx \)
\( \pmÉ¿ÁÓš. \)

(b) If \( f \in R(\alpha) \) and \( f \in R(\beta) \) on \([a,b]\). Prove that \( f \in R(C, \alpha + C, \beta) \) on \([a,b]\).
\( [a,b] - ø f \in R(\alpha) \) and \( f \in R(\beta) \) \( \pmÉöô [a,b] - ø f \in R(C, \alpha + C, \beta) \) \( \pmÉ¿ÁÓš. \)

Section – C

16.(a) State and Prove Boljano – Weierstra as theorem.
\( [\underbrace{\underbrace{\underbrace{\underbrace{A}}_{\alpha}}_{\beta}}_{\gamma}] \subseteq \pmÉ¿ÁÓš. \)

(b) State and Prove Corntor’s intersection theorem.
\( [\underbrace{\underbrace{\underbrace{\underbrace{\overline{A}}_{\alpha}}_{\beta}}_{\gamma}] \subseteq \pmÉ¿ÁÓš. \)

17.(a) State and Prove Heine-Borel Covering theorem.
\( [\underbrace{\underbrace{\underbrace{\underbrace{\overline{A}}_{\alpha}}_{\beta}}_{\gamma}] \subseteq \pmÉ¿ÁÓš. \)

(b) If \( S \) in a Subset of \( R^n \) , show that the following statements and equivalent
(i) \( S \) is compact
(ii) \( S \) is closed and bounded
(iii) Every infinite subset of \( S \) has an accumulation point in \( S \).
18. (a) If \( f: S \to T \) is a function from \((S, d_S)\) to \((T, d_T)\) show that \( f \) is continuous on \( S \) if and only if for every open set \( Y \) in \( T \), \( f^{-1}(Y) \) is open in \( S \).

(b) If \( f: S \to T \) is a continuous and \( 1-1 \) function from \((S, d_S)\) to \((T, d_T)\) and if \( f \) in compact on \( S \), show that \( f^{-1} \) is a continuous on \( f(S) \).

19. (a) Let \( f \) be of bounded variation on \([a,b]\) and let \( c \in (a,b) \). Then prove that \( f \) is of bounded variation on \([a,c]\) and \([c,b]\) and \( V_f([a,b]) = V_f([a,c]) + V_f([c,b]) \).

(b) If \( f \) is continuous on \([a,b]\), show that \( f \) is of bounded variation on \([a,b]\) if and only if \( f \) can be expressed as the difference of two increasing continuous functions.

20. (a) If \( f \in R(\alpha) \) on \([a,b]\). Prove that \( \alpha \in R(f) \) on \([a,b]\) and

\[
\int_a^b f(x) \, d\alpha(x) + \int_a^b \alpha(x) \, df(x) = f(b)\alpha(b) - f(a)\alpha(a)
\]

\([a,b] \in R(\alpha), [a,b] \in R(f) \Rightarrow \int_a^b f(x) \, d\alpha(x) + \int_a^b \alpha(x) \, df(x) = f(b)\alpha(b) - f(a)\alpha(a) \).

(b) Assume \( f \in R(\alpha) \) \([a,b]\) and \( \alpha \) has continuous derivative \( \alpha^1 \) on \([a,b]\). Show that

\[
\int_a^b f(x) \alpha^1(x) \, dx \exists \quad \text{and} \quad \int_a^b f(x) \, d\alpha(x) = \int_a^b f(x) \alpha^1(x) \, dx
\]

\([a,b] \in R(\alpha), A\tilde{u}\tilde{u}\tilde{o} \in R(\alpha) \Rightarrow \int_a^b f(x) \alpha^1(x) \, dx \exists \quad \text{and} \quad \int_a^b f(x) \, d\alpha(x) = \int_a^b f(x) \alpha^1(x) \, dx \).

(Or)
AOS – Numerical Methods I

Time : 3 Hours

Section – A (10 x 1 = 10 Marks)
Answer all Questions

(1) The equation \( x^3 - 4x - 9 = 0 \) will have a real root between ____________

(2) The order of convergence of Newton-Raphson method is ________________

(3) Gauss elimination method is a .......... method.

(4) The rate of convergence of Gauss – Seidal method is roughly ................. that of Jwabi method.

(5) \( \Delta^2 \) is called the ............... order difference operator.

(6) The central difference \( \delta y_x = \) ............

(7) State Gauss’s forward interpolation formula

(8) State Stirling’s formula

(9) If \( f(x) = 1/x \) find the divided difference \( f(a,b) \) and \( f(a,b,c) \).

Section B (5 x 6 = 30 Marks)

(11) (a) Obtain a root of \( x^3 - x - 1 = 0 \) using bi section method.

(b) Describe the method of false position.

(12) (a) Solve by Gauss elimination method.

\[
\begin{align*}
3x - y + 2z &= 12 \\
x + 2y + 3z &= 11 \\
2x - 2y - z &= 2
\end{align*}
\]
3x – y + 2z = 12
x + 2y + 3z = 11
2x – 2y – z = 2

(or)

(b) Using Gauss – Jordan method, solve.

2x – 3y + z = -1
x + 4y + 5z = 25
3x – 4y + z = 2

(13) (a) Show that

\[ y_3 = y_2 + \Delta y_1 \]
\[ y_3 = y_2 + \Delta^2 y_0 + \Delta^3 y_0 \]

(or)

(b) Obtain the function whose first difference is \( 9x^2 + 11x + 5 \)

(14) (a) Using the following table, apply Gauss’s forward formula to get \( f(3.75) \)

<table>
<thead>
<tr>
<th>( x )</th>
<th>2.5</th>
<th>3.0</th>
<th>3.5</th>
<th>4.0</th>
<th>4.5</th>
<th>5.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>( f(x) )</td>
<td>24.145</td>
<td>22.043</td>
<td>20.225</td>
<td>18.644</td>
<td>17.262</td>
<td>16.047</td>
</tr>
</tbody>
</table>

(b) If \( \sqrt{12500} = 111.803399, \sqrt{12510} = 111.848111, \sqrt{12520} = 111.892805, \sqrt{12530} = 111.937483 \) find \( \sqrt{12516} \) by Gauss’s backward formula.

\[ \sqrt{12500} = 111.803399, \sqrt{12510} = 111.848111, \sqrt{12520} = 111.892805, \sqrt{12530} = 111.937483 \]
(15) (a) From the following table find \( f(x) \) and hence \( f(6) \) using Newton's interpeter formula.

\[
\begin{array}{c|c|c|c|c}
 x & 1 & 2 & 7 & 8 \\
 f(x) & 1 & 5 & 5 & 4 \\
\end{array}
\]

(b) Using Lagrange's formula of interpertation find \( y(9.5) \) given

\[
\begin{array}{c|c|c|c|c}
 x & 7 & 8 & 9 & 10 \\
y & 3 & 1 & 1 & 9 \\
\end{array}
\]

Section – C (5 x 12 = 60 Marks)

(16) (a) Find the positive roof of \( x_e^x = 2 \) by the method of false position.

\[
x_e^x = 2
\]

(or)

(b) Find the real root of the equation \( x^3 - 6x + 4 = 0 \) between 0 and 1 using Newton – Raphson method.

\[
x^3 - 6x + 4 = 0
\]

(17) (a) Solve by Gauss – Seidal method.

\[
\begin{align*}
28x + 4y - z &= 32 \\
2x + 17y + 4z &= 35 \\
x + 3y + 10z &= 24
\end{align*}
\]
(b) Using Gauss-Jacobe method solve.

\[ \begin{align*}
  x + 17y - 2z &= 48 \\
  30x - 2y + 3z &= 75 \\
  2x + 2y + 18z &= 30
\end{align*} \]

(18) (a) Express any value \( f \) \( Y \) in terms of \( Y_n \) and the backward differences of \( Y_n \).

(19) (a) Find the value of \( \cos 510.421 \) by using Gauss’s backward interpolation formula from the table given below.

<table>
<thead>
<tr>
<th>( X )</th>
<th>500</th>
<th>510</th>
<th>520</th>
<th>530</th>
<th>540</th>
</tr>
</thead>
<tbody>
<tr>
<td>( Y = \cos x )</td>
<td>.6428</td>
<td>.6293</td>
<td>.6157</td>
<td>.6018</td>
<td>.5878</td>
</tr>
</tbody>
</table>

(b) From the following table using Stirling’s formula estimate the value of \( \tan 16^\circ \)

<table>
<thead>
<tr>
<th>( X )</th>
<th>00</th>
<th>50</th>
<th>100</th>
<th>150</th>
<th>200</th>
<th>250</th>
<th>300</th>
</tr>
</thead>
<tbody>
<tr>
<td>( Y = \tan x )</td>
<td>0.0</td>
<td>0.0875</td>
<td>0.1763</td>
<td>0.2679</td>
<td>0.3640</td>
<td>0.4663</td>
<td>0.5774</td>
</tr>
</tbody>
</table>

(20) (a) Using Newton’s divided difference formula, find the values of \( f(2), \ f(8) \) and \( f(15) \) given the following table.

<table>
<thead>
<tr>
<th>( X )</th>
<th>4</th>
<th>5</th>
<th>7</th>
<th>10</th>
<th>11</th>
</tr>
</thead>
<tbody>
<tr>
<td>( F(x) )</td>
<td>4.8</td>
<td>100</td>
<td>294</td>
<td>900</td>
<td>2028</td>
</tr>
</tbody>
</table>
(b) find the value of $\theta$ given $f(\theta) = .3887$ where $f(\theta) = \int_{0}^{\theta} \frac{d\theta}{\sqrt{1 - \frac{1}{2} \sin^2 \theta}}$ using the table

<table>
<thead>
<tr>
<th>$\theta$</th>
<th>$21^0$</th>
<th>$23^0$</th>
<th>$25^0$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$f(\theta)$</td>
<td>.3706</td>
<td>.4068</td>
<td>.4433</td>
</tr>
</tbody>
</table>

(or)

\[ f(\theta) = \int_{0}^{\theta} \frac{d\theta}{\sqrt{1 - \frac{1}{2} \sin^2 \theta}} \]

<table>
<thead>
<tr>
<th>$\theta$</th>
<th>$21^0$</th>
<th>$23^0$</th>
<th>$25^0$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$f(\theta)$</td>
<td>.3706</td>
<td>.4068</td>
<td>.4433</td>
</tr>
</tbody>
</table>

DISCRETE MATHEMATICS

Time : 3 Hours
Maximum : 100 Marks

SECTION – A
(10 X 1 = 10)

1. A ______ is an expression which is a string consisting of variables, parentheses and connective symbols.

2. The dual of $(P \land Q) \lor T$ is ______

3. $P \rightarrow Q \iff ______

4. If $f(x) = x + 2$ and $g(x) = x^2 - 1$ then find $(g \circ f)(x)$

5. If $s \rightarrow \alpha$ and $s \rightarrow \alpha$ be the productions in a grammar $G$, then the grammar is called ________.

6. ______ is one in which rows are represented by states and columns are represented by input symbols.

7. $(\alpha, *, \oplus)$ be a lattice and $a, b \in L$, then $a * (a \oplus b) = a$ is called ______

8. If $a$ and $b$ be any two elements of a Boolean algebra then $a * (a' \oplus b) = ______$

9. A graph that has neither self loops nor parallel edges is called a ______

10. If the degree of the vertex are equal then it is called _______
SECTION – B

11. (a) Prove that \( P \rightarrow (Q \rightarrow R) \iff (P \land Q) \rightarrow R. \)

(b) Obtain the principle conjunctive normal form of
\[
P \lor (7P \rightarrow (Q \lor (7Q \rightarrow R)))
\]

12. (a) Show that \((7P \land (7Q \land R)) \lor (Q \land R) \lor (P \land R) \iff R \)

(b) Define Composite function. Also let \( f : \mathbb{R} \rightarrow \mathbb{R} \) and \( g : \mathbb{R} \rightarrow \mathbb{R} \) defined by \( f(x) = 4x - 1, \ g(x) = \cos x \) then find \( fog \) and \( gof \).

13. (a) Define
(i) Deterministic Finite Automaton.
(ii) Non Deterministic Finite Automaton.

(b) Explain the procedure for converting the given non-deterministic finite automata and finite automata.

14 (a) State and Prove the distributive in equality of a lattice.

(b) In any Boolean Algebra, Prove that \((a \land b)' = a' \lor b' \) and \((a \lor b)' = a' \land b' \)

15 (a) Define the following terms with example.
(i) Connected Graph
(ii) Hamiltonian Cycle

(b) “Every tree can be uniquely represented by a binary tree” discuss with example.

SECTION – C

16 (a) Show that
(i) \( 7(P \land Q) \rightarrow (7P \lor (7P \lor Q)) \iff (7P \lor Q) \)
(ii) \((P \lor Q) \land (7P \lor (7P \lor Q)) \iff (7P \land Q) \)

(b) Show that the following are equivalent formulae
(i) \( P \lor (P \land Q) \iff P \)
(ii) \( P \lor (7P \land Q) \iff P \lor Q \)

17 (a) Show that
(i) \((x) (P(x) \lor Q(x)) \Rightarrow (x) P(x) \lor (\exists x) Q(x) \)

(b) (i) What is equivalence relation? Give an example.

(ii) Let \( R \) be a binary relation on the set of all positive integers such that \( R = \{ (a,b) \mid a = b^2 \} \). Is \( R \) Reflexive? Symmetric? Anti Symmetric?.

18 (a) Define the following grammar.
(i) Context Sensitive Grammar
(ii) Context Free Grammar
(iii) Regular Grammar

(OR)

(b) Explain deterministic finite automaton. Also give a DFA accepting the set of all strings over \{0,1\} with three consecutive 0’s.

19 (a) Let \((<,\leq)\) be a lattice. For any \(a, b, c \in L\). Prove that the following distributive inequations hold
\[
\begin{align*}
    a \oplus (b \ast c) & \leq (a \oplus b) \ast (a \oplus c) \\
    a \ast (b \oplus c) & \geq (a \ast b) \oplus (a \ast c)
\end{align*}
\]

(OR)

(b) Find the canonical form of a Boolean function.
\[
F = [x + (x' + y)'] \ast [x + (y' \ast z')']
\]

20 (a) Define the following with an example.
(i) Multi Graph
(ii) Euler Graph
(iii) Isomorphic Graph

(OR)

(b) Explain the matrix representation of graphs with example.
b. If G is a connected graph with exactly 2k odd vertices, prove that there exist k edge-disjoint subgraphs such that they together contain all edges of G and that each is a univursal graph.

12. a. Prove that a tree with n vertices has (n-1) edges.
   (OR)
   b. Prove that a graph with n vertices (n-1) edges and no circuits is connected.

13. a. Define the vertex connectivity and edge connectivity of a graph. Prove that the vertex connectivity of a graph can never exceed its edge connectivity.
   (OR)
   b. Prove that the complete graph on five vertices is non planar.

14 a. If B is a circuit matrix of a connected graph G with e edges and n vertices, prove that rank of B = e-n+1
   (OR)
   b. Define path matrix and illustrate with an example

15. a. Prove that every tree with two or more vertices is 2 – chromatic
   (OR)
   b. Prove that a graph on n vertices is complete if and only if its chromatic polynomial
   is pn(λ)=λ(λ-1)(λ-2)….λ-n+1

Section - C (5x12=60)

16. a. Prove that a simple graph on n vertices and k components can have almost (n-k) (n-k+1)/2 edges.
   (OR)
   b. Prove that a connected graph is an Euler graph if and only if all vertices are of even degree.

17. a. Define the center of a graph. Prove that every tree has either one vertex or two adjacent vertices as its center.
   (OR)
   b. Prove that a spinning tree T of a given weighted connected graph is a shortest spanning tree of G if and only if there exists no other spinning tree of G if and only if there exists no other spanning tree of G at a distance of one from T whose weight is smaller than that of T.

18. a. Prove that the maximum vertex connectivity that can achieve with a graph on n vertices and e edges (e ≥ n-1) is (2e/n)
   (OR)
   b. State and prove the Euler’s Formula for a connected planar graph.

19. a. Prove that the rank of A(G) is n-1 Where A(G) is the incidence matrix of a connected graph G.
(OR)

b. If A and B are respectively, the circuit matrix and the incidence matrix whose columns are arranged using the same order of edges, prove that $A \cdot B^T = B \cdot A^T = 0 \pmod{2}$

20

a. Explain what is a chromatic number and chromatic polynomial of a graph. Find the chromatic polynomial for the graph $G$ given below.

```
V2
V1
V3
V5
V4
```

(OR)

b. Prove that the vertices of every planar graph can be properly colored with five colors.

**********

AOS – Numerical Methods II

Time : 3 Hours

Maximum : 100 Marks

Section – A (10 x 1 = 10 Marks)

Answer all Questions

1. The relation between $E$ and $\Delta$ is ............

$E kw; Wk; \Delta d; bjhlh; g$ [ //////////]

2. $y_p = y_0 + p\Delta y_0$ of Gregory Newton formula corresponds to .................


$Rpk; rdpd; 1-3 Nj;jpui; ij vGJf/$


$Oug; rha; ly; Nj;jpu; ij vGJf/$

5. Newton’s divided difference formula for equal intervals is called ______________

6. $\delta$ is given in terms of $E$ as ..................

$\delta$ vd: gJ E-ia bgHwJ [ ///////////]

$\delta$
7. Write down the Milne’s predictor and Corrector algorithm.

8. Write decon Reange – Kutta algorithm (4th order)
   \( u';nf ? Fl;lh Kiwia vGJf/ \)

9. Euler’s method is a Taylor’s series method of .......... order.
   Ma;y; Kiw vd;gJ ila;yh; bjhlhp; /////////////// thpir MFk;/

10. State the Adams – Bashforth Predictor corrected formula.

Section – B (5 x 6 = 30 Marks)

(11) (a) Find the first derivative of the function tabulated below at \( x = 0.6 \)

\[
\begin{array}{cccccc}
\hline
x & 0.4 & 0.5 & 0.6 & 0.7 & 0.8 \\
Y & 1.5836 & 1.7974 & 2.0442 & 2.3275 & 2.6511 \\
\hline
\end{array}
\]

(OR)
(11) (b) Given the following data, find the maximum value of \( y \)

\[
\begin{array}{cccccc}
\hline
x & 0 & 1 & 2 & 3 & 4 & 5 \\
y & 0 & 0.25 & 0 & 2.25 & 16.00 & 56.25 \\
\hline
\end{array}
\]

(12) a) Using the following data, find \( f'(5) \).

\[
\begin{array}{cccccc}
\hline
x & 0 & 2 & 3 & 4 & 7 & 9 \\
y & 4 & 26 & 58 & 112 & 466 & 922 \\
\hline
\end{array}
\]

(OR)
(12) (b) Evaluate \( \int_{0}^{1} \frac{1}{1+x^2} \,dx \) using Trapezoidal rule with \( h = 0.25 \);
h = 0.25 vdf; bfhz;L rhptf tpjppia gad;gLj;jp $\int_{0}^{1} \frac{1}{1+x^2} dx$; kjpg;ig fzf;fpLf/

(13)  (a) Find the difference equation from $y_x = a.2^x + b.3^x$

$y_x = a.2^x + b.3^x$  ypUe;J tpj;jpaahr rkd;ghl;ilf; fhz;f/ (OR)

(b) Find the difference equation from $y_x = a.2^x + b(-2)^x$

$y_x = a.2^x + b(-2)^x$  ypUe;J tpj;jpaahr rkd;ghl;ilf; fhz;f/ (OR)

(14) (a) Using Taylor’s series method find $y(0.1)$ given $\frac{dy}{dx} = x + y, y(0) = 1$.

$\frac{dy}{dx} = x + y, y(0) = 1$ vdpy; blaj;ypd; bjhlj u cgnahfg;gLj;jp; kjg;igf; y(0.1) fhz;f/

(OR)

(b) Given $y' = -y$ and $y(0) = 1$ determine the values of $y$ at $x=.01, .02$ by Euler method.

$y' = -y, y(0) = 1$ vdpy; yd; kjpg;ig x = .01, kw;Wk; x = .02 vd;gjpy; Ma;ypd; Kiwia gad;gLj;jp; fhz;f/

(OR)

(15) (a) Using mile’s method find $y(4.4)$ given $5xy' + y^2 - 2 = 0$ given $y(4) = 1,$

$y(4.1)=1.0049$  $y(4.2) = 1.0097$ and $y(4.3) = 1.0143$.

,  $y(4.1)=1.0049$  $y(4.2) = 1.0097$ and $y(4.3) = 1.0143$ vdpy; kpy;dP!; Kiwia; gad;gLj;jp y(4.4)d; kjpg;igf; fhz;f/

(OR)

(b) Solve and get $y(2)$ given $\frac{dy}{dx} = \frac{1}{2}(x+y)$, $y(0) = 2$  $y(0.3) = 2.636$  $y(1) = 3.595$

$y(1.5) = 4.968$ by Adam’s method.

$\frac{dy}{dx} = \frac{1}{2}(x+y), y(0) = 2$  $y(0.3) = 2.636$  $y(1) = 3.595$  $y(1.5) = 4.968$vdpy; Mlk;!; Kiwia; gad;gLj;jp y(2) d; kjpg;igf; fhz;f/

Section – C (5 x 12 = 60 Marks)

(16) (a) Use Newton-Gregory forward formula find the value of $Y$ when $x=142^0$

<table>
<thead>
<tr>
<th>x</th>
<th>140°</th>
<th>150°</th>
<th>160°</th>
<th>170°</th>
<th>180°</th>
</tr>
</thead>
<tbody>
<tr>
<td>y</td>
<td>3.685</td>
<td>4.854</td>
<td>6.302</td>
<td>8.076</td>
<td>10.225</td>
</tr>
</tbody>
</table>
(b) Derive Newton-Gregory backward difference formula for interpolation.

(17) (a) Evaluate \[ \int_{0}^{1} e^x \, dx \] by Simpson’s me third rule correct to five decimal places, by proper choice of h.

\[ \frac{3}{2} \int_{0}^{1} e^x \, dx \]

(OR)

(b) Evaluate \[ \int_{-3}^{3} x^4 \, dx \] by using (1) Trapezoidal rule (2) Simpson’s rule verify your results by actual integration.

\[ \int_{-3}^{3} x^4 \, dx \]

(18) (a) Solve \[ y_{x+2} - y_{x+1} + y_x = 0 \] given \[ y_0 = 1, y_1 = \frac{\sqrt{3} + 1}{2} \]

\[ y_0 = 1, y_1 = \frac{\sqrt{3} + 1}{2} \quad \text{vdpy;} \quad y_{x+2} - y_{x+1} + y_x = 0 \]

(OR)

(b) Solve \[ \Delta u_x + \Delta_2 u_x = \cos x \]

(19) (a) Compute y at x = 0.25 by modified Euler method given \[ y' = 2xy, \quad y(0) = 1 \]

Ma;yhpd; g[JKiwia gadgLj;jp yd; kjpg;ig x= 0.25 vDk; ,lj;jpy; \quad y' = 2xy, \quad y(0) = 1vd;gij itj;J fhz;f/ (OR)

(b) Apply the fourth order Range kutta method to fixed y(0.2) given that \[ y' = x + y, \quad y(0) = 1 \]

(OR)

(b) Apply the fourth order Range kutta method to fixed y(0.2) given that \[ y' = x + y, \quad y(0) = 1 \]

(20) (a) Determine the value of y(0.4) using Mline’s method given \[ y' = xy + y^2, \quad y(0) = 1 \] use Taylor series to get the values of y(0.1), y(0.2) and y(0.3)
\[ y' = xy + y^2, \quad y(0) = 1 \text{ vdp}; \quad y(0.1), \quad y(0.2) \text{ kw}; \quad y(0.3) \text{ d}; \quad kjpg;g[fis bla; yhp; Nj;jpu;jij gad;gL;jjp bgw;W \ y(0.4) \text{ d}; \quad kjpg;ig \Kiwa gad;gL;jjp fhz;f/ \]

(OR)

(b) Find \( y(0.1), \ y(0.2), \ y(0.3) \) from \( \frac{dy}{dx} = xy + y^2, \ y(0) = 1 \) by using Runge-kutta method and hence obtain \( y(0.4) \) using Adam's method.

\[ \frac{dy}{dx} = xy + y^2, \ y(0) = 1 \text{ vdp}; \quad y(0.1), \quad y(0.2) \text{ kw}; \quad y(0.3) \text{ d}; \quad kjpg;g[fis u';nf Fl;h Kiwa gad;gL;jjp fhz;f/ \ nkYk; \ y(0.4) \text{ d}; \quad kjpg;ig Adam?d; \ Kiwa gad;gL;jjp fhz;f/ \]

---

### OPERATIONS RESEARCH - I

**Time:** 3 Hours  
**Maximum:** 100 Marks

**SECTION – A**  
(10 X 1 = 10)

1. Give any two definitions or OR.

2. Write down the phases of OR.

3. Define Feasible solution.

4. Define Slash Variable.

5. What is meant by dual problem?

6. The dual of dual is ______.

7. Define : Non – degenerate basic feasible solution in transportation model.

8. What is optimum utilization of the transportation model?

9. Compare Transportation and Assignment models.

10. Write down the mathematical representation of assignment models.

**SECTION – B**  
(5 X 6 = 30)

11 (a) Briefly explain scientific methods in operations research.

(OR)

(b) Discuss the significance and scope of OR in modern management.

12 (a) Show that these is an unbounded solution to the following L.P.P.

Maximize \( Z = 4x_1 + x_2 + 3x_3 + 5x_4 \)

Subject to
13 (a) Write the dual of the following L.P.P.
(i) Maximize \( Z = 5x_1 + 8x_2 \)
Subject to
\[
3x_1 + 5x_2 = 18 \\
5x_1 + 3x_2 = 14
\]
\( x_1, x_2 \geq 0 \)

(ii) Maximize \( Z = 5x_1 + 8x_2 \)
Subject to
\[
x_1 - 2x_2 \leq 1 \\
x_1 + 2x_2 \geq 3
\]
\( x_1, x_2 \geq 0 \)

(OR)

(b) What are the steps involved in charnes penalty method?

Write the dual of the following L.P.P.
(i) Minimize \( Z = x_1 + 2x_2 + x_3 \)
Subject to
\[
\frac{1}{2} x_1 + \frac{1}{2} x_2 + \frac{1}{2} x_3 \leq 1 \\
\frac{3}{2} x_1 + 2x_2 + x_3 \geq 8 \\
x_1, x_2, x_3 \geq 0
\]

(ii) Minimize \( Z = 2x_1 + 3x_2 \)
Subject to
\[
x_1 - 2x_2 \leq 0 \\
-2x_1 + 3x_2 \geq -6
\]
\( x_1, x_2 \) Unrestricted
\[
x_1 + \frac{1}{2}x_2 + \frac{1}{2}x_3 \leq 1
\]
\[
\frac{3}{2}x_1 + 2x_2 + x_3 \geq 8 \quad x_1, x_2, x_3 \geq 0
\]

(ii) \[\text{Maximize } Z = 2x_1 + 3x_2\]

\[\text{subject to } x_1 - 2x_2 \leq 0\]
\[-2x_1 + 3x_2 \geq -6\]

\[x_1, x_2 \text{ Unrestricted}\]

14 (a) Explain the Voge's Approximation method.

(b) What are the steps involved in formulation of transportation?

15 (a) A company has a team of four salesman and these are four districts where the company wants to start its business. After talking into account the capabilities of salesman and the nature of districtly the company estimates that the profit per day in rupees for each salesman in each district is as below.

<table>
<thead>
<tr>
<th>District</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>16</td>
<td>10</td>
<td>14</td>
<td>11</td>
</tr>
<tr>
<td>B</td>
<td>14</td>
<td>11</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td>C</td>
<td>15</td>
<td>15</td>
<td>13</td>
<td>12</td>
</tr>
<tr>
<td>D</td>
<td>13</td>
<td>12</td>
<td>14</td>
<td>15</td>
</tr>
</tbody>
</table>

(OR)

(b) Solve the following Assignment Problem.

<table>
<thead>
<tr>
<th>I</th>
<th>II</th>
<th>III</th>
<th>IV</th>
<th>V</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>11</td>
<td>17</td>
<td>8</td>
<td>16</td>
</tr>
<tr>
<td>2</td>
<td>9</td>
<td>7</td>
<td>12</td>
<td>6</td>
</tr>
<tr>
<td>3</td>
<td>13</td>
<td>16</td>
<td>15</td>
<td>12</td>
</tr>
<tr>
<td>4</td>
<td>21</td>
<td>24</td>
<td>17</td>
<td>28</td>
</tr>
<tr>
<td>5</td>
<td>14</td>
<td>10</td>
<td>12</td>
<td>11</td>
</tr>
</tbody>
</table>

(OR)
SECTION – C

( 5 X 12 = 60 )

16 (a) Discuss the role of OR models in decision making.

(OR)

(b) Find the maximum as well as minimum value of the objective function \( Z = 4x + 5y \)

Subject to

\[
\begin{align*}
2x + y & \leq 6 \\
\quad x + 2y & \leq 5 \\
\quad x - 2y & \leq 2 \\
\quad -x + y & \leq 2 \\
\quad x + y & \geq 1 \quad x, y \geq 0
\end{align*}
\]

by using graphical method.

17 (a) Use M-technique to solve the following L.P.P.

Minimize \( Z = 4x_1 + x_2 \)

Subject to

\[
\begin{align*}
3x_1 + x_2 & = 3 \\
4x_1 + 3x_2 & \geq 6 \\
\quad x_1 + 2x_2 & \leq 3 \\
\quad x_1, x_2 & \geq 0
\end{align*}
\]

(OR)

(b) Use two phase method to solve

Maximize \( Z = 5x - 2y + 3z \)

Subject to

\[
\begin{align*}
\quad 2x + 2y - z & \geq 2 \\
\quad 3x - 4y & \leq 5 \\
\quad y + 3z & \leq 5 \\
\quad x, y, z & \geq 0
\end{align*}
\]
18  (a) Use duality to solve the following L.P.P.
Maximize \( Z = 3x_1 + 2x_2 \)
Subject to
\[
\begin{align*}
  x_1 + x_2 & \geq 1 \\
  x_1 + x_2 & \leq 7 \\
  x_1 + 2x_2 & \leq 10 \\
  x_2 & \leq 3 \\
  x_1, x_2 & \geq 0
\end{align*}
\]

(OR)

(b) Use Duality to solve the following L.P.P.
Minimize \( Z = 3x_1 + 2x_2 + 5x_3 \)
Subject to
\[
\begin{align*}
  x_1 + x_2 + x_3 & \leq 9 \\
  2x_1 + 3x_2 + 5x_3 & \leq 30 \\
  2x_1 - x_2 - x_3 & \leq 8 \\
  x_1, x_2, x_3 & \geq 0
\end{align*}
\]

19  (a) Give a mathematical formulation of the transportation and simplex methods. What are the difference in the nature of problems that can be solved by these methods.

(OR)

(b) Solve the following transportation problem.

<table>
<thead>
<tr>
<th>Stores (Destination)</th>
<th>Surplus</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
20 (a) Explain the Hungarian Assignment Algorithm.

(OR)

(b) Solve the following Assignment Problem.

\[
\begin{array}{cccccc}
A & 12 & 10 & 15 & 22 & 18 & 8 \\
B & 10 & 18 & 25 & 15 & 16 & 12 \\
C & 11 & 10 & 3 & 8 & 5 & 9 \\
D & 6 & 14 & 10 & 13 & 13 & 12 \\
E & 8 & 12 & 11 & 7 & 13 & 10 \\
\end{array}
\]
OPERATIONS RESEARCH - II

Time : 3 Hours
Maximum : 100 Marks

SECTION – A

(10 X 1 = 10)

1. What are the rules for graph theory?.
   Δε’ζΑ¡δ Δοεδιε,εγζ Δε%εζ,ζ ΩΩ,

2. Define: optimal strategies.
   Α’ΑΑУ : δ%Α ιέδΑέ


5. Define: Demand.
   Α’ΑΑУ : §%$%

   ΖΟ-Α Α’ΑΑУ (») §α,ΑεδΩ Α-ΑΑУ

7. What is simulation?.

8. What is monte – carlo method ?.
   Α¡η§¡ô-,¡+§¡ι ΩΩ±y±€±y±€?

   Α’ΑΑУ : Α¡³

10. Define: Successor activities.

SECTION – B

(5 X 6 = 30)

11 (a) Explain Two person zero sum game
   ΠΟΑ+ ¥fεΑ Úδ%δ Αε’ζΑ¡δÇ Δε’Ε ΑέΑΑε.

(OR)

(b) Write down the properties of competitive Games.
   §Λ¡δÇ Αε’ζΑ¡δÇ Αε,ζ +ΩΔ,

12 (a) Explain the classification of Queueing system.
   ΑΑε+³%¡λοαέγ Α”,ζ ΑεΑΑε.

(OR)

(b) Explain the elements of Queueing system.
   ΑΑε+³%¡λοαέγ =¡,ζ ΑεΑΑε.

13 (a) Explain the various costs associated with inventory control.
   §Αιε%δ,ζ,ζΩ,ζ ΩΛ,ε%δ% Αε’Åεγ |Α±§ΔΑ Α”,ζ ΑεΑΑε.

(OR)

(b) Explain the E.O.Q. with price break.
   E.Q.O. Α Αε”Δ ΖεÚδ%δδδζδζ ΑεΑΑε.

14 (a) A tourist cab owner has 25 taxis in operation. He keeps three derives as
   reserve to attend to calls in case the scheduled driver reports sick the probability
   distribution of sick driver is as below.

<table>
<thead>
<tr>
<th>Number sick</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0.20</td>
</tr>
<tr>
<td>1</td>
<td>0.25</td>
</tr>
<tr>
<td>2</td>
<td>0.20</td>
</tr>
<tr>
<td>3</td>
<td>0.15</td>
</tr>
<tr>
<td>4</td>
<td>0.12</td>
</tr>
<tr>
<td>5</td>
<td>0.08</td>
</tr>
</tbody>
</table>
Use Monte Carlo method to estimate the utilization of reserve derives and the probability that at least one method will be off the road due to non-availability of a driver. Compare with the correct answer.

(OR)

(b) Find the value of \( \Pi \) experimentally by simulation.

15 (a) Write down the rules of Network Construction.

(OR)

(b) Construct the network diagram comprising activities B, C, ….. Q and N such that the following constraints are satisfied.

\[
\begin{align*}
&B < E, F; \quad C < G, L; \quad E, G < H; \quad L, H < I; \quad L < M; \quad H < N; \\
&H < J; \quad I, J < P; \quad P < Q
\end{align*}
\]

The relation \( X < Y \) means that the activity \( X \) must be finished before \( Y \) can begin.

\[
\begin{align*}
&B < E, F; \quad C < G, L; \quad E, G < H; \quad L, H < I; \quad L < M; \quad H < N; \\
&H < J; \quad I, J < P; \quad P < Q
\end{align*}
\]

(OR)

(5 X 12 = 60)

16 (a) Reduce the following game by dominance and find the game value.

\[
\begin{array}{|c|c|c|c|c|}
\hline
& I & II & III & IV \\
\hline
I & 3 & 2 & 4 & 0 \\
II & 3 & 4 & 2 & 4 \\
III & 4 & 2 & 4 & 0 \\
IV & 0 & 4 & 0 & 8 \\
\hline
\end{array}
\]

(OR)

(b) Solve the following game by graphic method.

\[
\begin{array}{|c|c|c|c|c|}
\hline
& I & II & III & IV \\
\hline
I & -5 & 5 & 0 & -1 \\
II & 8 & -4 & -1 & 6 \\
III & 0 & 4 & 0 & 8 \\
\hline
\end{array}
\]

\[
\begin{array}{|c|c|c|c|}
\hline
& I & II & III \\
\hline
I & -5 & 5 & -1 \\
II & 8 & -4 & -1 \\
\hline
\end{array}
\]

\[
\begin{array}{|c|c|c|}
\hline
& I & II \\
\hline
I & -5 & 5 \\
II & 8 & -4 \\
\hline
\end{array}
\]

\[
\begin{array}{|c|c|c|}
\hline
& I & II \\
\hline
I & -5 & 5 \\
II & 8 & -4 \\
\hline
\end{array}
\]

\[
\begin{array}{|c|c|c|}
\hline
& I & II \\
\hline
I & -5 & 5 \\
II & 8 & -4 \\
\hline
\end{array}
\]

\[
\begin{array}{|c|c|c|}
\hline
& I & II \\
\hline
I & -5 & 5 \\
II & 8 & -4 \\
\hline
\end{array}
\]

\[
\begin{array}{|c|c|c|}
\hline
& I & II \\
\hline
I & -5 & 5 \\
II & 8 & -4 \\
\hline
\end{array}
\]

\[
\begin{array}{|c|c|c|}
\hline
& I & II \\
\hline
I & -5 & 5 \\
II & 8 & -4 \\
\hline
\end{array}
\]

\[
\begin{array}{|c|c|c|}
\hline
& I & II \\
\hline
I & -5 & 5 \\
II & 8 & -4 \\
\hline
\end{array}
\]

\[
\begin{array}{|c|c|c|}
\hline
& I & II \\
\hline
I & -5 & 5 \\
II & 8 & -4 \\
\hline
\end{array}
\]
17  (a) Explain the characteristics of Queueing Models.

(b) A supermarket has two girls running up sales at the counters. If the service time for each customer is exponential with mean 6 minutes and if people arrive in a Poisson fashion at the rate of 12 per hour,

(i) What is the probability of having to wait for service?
(ii) What is the expected number of customers in the queue?

18  (a) Derive the EOQ formula for shortage model.

(b) The annual demand for a product 1,00,000 units. The rate of production is 2,00,000 units per year. The set up cost per production run is Rs.5,000 and the production cost of each item is Rs.10. The annual holding cost per unit is 20% of the value of the unit. Find the optimum production lot-size and the length of the production run.

19  (a) Three points are chosen at random on the circumference of a circle. Find by Monte-Carlo methods the probability that they lie on the same semi-circle.

(b) A company has a single service station which has the following characteristics the mean arrival rate of customer and the mean service time 6.2 minutes and 5.5 minutes respectively. The time between and arrival and its service varies from one minute to seven minutes. The time distribution are given below.

<table>
<thead>
<tr>
<th>Time (Minutes)</th>
<th>Arrival (Probability)</th>
<th>Service (Probability)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-2</td>
<td>0.05</td>
<td>0.10</td>
</tr>
<tr>
<td>2-3</td>
<td>0.20</td>
<td>0.20</td>
</tr>
<tr>
<td>3-4</td>
<td>0.35</td>
<td>0.40</td>
</tr>
<tr>
<td>4-5</td>
<td>0.25</td>
<td>0.20</td>
</tr>
<tr>
<td>5-6</td>
<td>0.10</td>
<td>0.10</td>
</tr>
<tr>
<td>6-7</td>
<td>0.05</td>
<td>-</td>
</tr>
</tbody>
</table>

The queueing process starts at 11 A.M. and closes at 12 P.M. An arrival moves immediately into the service facility if it is empty. On the other hand if the service station is busy, the arrival will wait in the queue. Customers are served on the first come, first served basis.
If the clerk’s wages are Rs.6 per hour, would the customer’s waiting line costs, Rs.5 per hour, would it be economical for the manager to engage the second clerk? Use Monte – carlo simulation technique.

20  (a) Calculate the variance and expected activity times for the activities of the network shown in the figure below under calculation in the tabular form.

(b) Activity 1-2 1-3 1-4 2-5 3-5 4-6 5-6
    to   1  1  1  2  1  2  3
    tm   1  4  2  1  5  5  6
    tp   7  7  8  1 14  8 15

(i) Draw the project network and identify all the paths throughout
(ii) What is the expected project length?
(iii) Calculate the variance D.S.D. OF project length
(iv) If the project due date is 18 weeks, what is the probability of not meet the due date?
OPERATIONS RESEARCH - III

Time : 3 Hours      Maximum : 100 Marks

SECTION – A

1. What is L.P.P.?
ÔØ ±ñ ¾¢ð¼ ,½ì±ýÈ¡ø ±ýÉ?

2. What is Gamorian constraints?
§¸¡Áâ¢ý ¸ðÎôÀ¡Î¸û ±ýÈ¡ø ±ýÉ?

3. Write down a General N.L.P.P.
§À± ½±õÁÀçÊ Àíä ¾¢ð¼ ,½ì±ýÈ¡ø ±ýÉ?

4. Write down Keeton – Tucter conditions.
¦¸¡û¨¸¨Â ±ØÐ.

5. What is Dynamic Programming Problem?
þÂø þÁì¸Å¢Âø ¾¢ð¼ ¸½ìÌ ±ýÈ¡ø ±ýÉ?

6. Write down the principle of optimality in Dynamic Programming Problem.
¦¸¡û¨¸¨Â ±ØÐ.

7. Define Stochastic Process
Ç¼¡ì¸¡ŠÊì þÁì¸õ ŨÃÂÚ.

8. What is mean by transition probability?.
Á¡Ú¾ø ¿¢¸ú¾¸× ±ýÈ¡ø ±ýÉ?

9. Write the basic steps involved in the Laplace criterion.
Ä¡ôġР¾¢ð¼ «Ç¨Å¢ø þ¼õ ¦ÀÚõ «ÊôÀ¨¼ Àʸû ¡¨Å?

10. What is EMV.
EMV ±ýÈ¡ø ±ýÉ?

SECTION – B

11. (a) Explain All Integer Cutting Plane Algorithm.
±öÁ i ŎØi,Çøø ¡Ádïó ¾¢ç ½Øì ÔØ ¾¢ð¼ ¾ç ¼ 4 ÄéÇüì,ö
,iñ.,

(OR)

(b) Explain Mixed Integer Cutting Plane Algorithm.
Á‘Á ¿©é ½Øí,Çøø ¡Ádïó ¾¢ç ½Øì ÔØ ¾¢ð¼ ¾ç ¼ 4 ÄéÇüì,ö
,iñ.,

12. (a) Obtain the set of necessary condition for the non-linear programming problem.
Maximize
Z = x_1^2 + 3x_2^2 + 5x_3^2
Subject to
\begin{align*}
x_1 + x_2 + 3x_3 &= 2 \\
5x_1 + 2x_2 + x_3 &= 5 \\
\end{align*}
\begin{align*}
\text{subject to} \quad x_1, x_2, x_3 &\geq 0
\end{align*}

(OR)

(b) Solve the following L.P.P.
Minimize
Z = 2x_1^2 - 24x_1 + 2x_2^2 - 8x_2 + 2x_3^2 - 12x_3 + 200
Subject to
\begin{align*}
x_1 + x_2 + x_3 &= 11 \\
5x_1 + 2x_2 + x_3 &= 5 \\
\end{align*}
\begin{align*}
\text{subject to} \quad x_1, x_2, x_3 &\geq 0
\end{align*}
13 (a) Briefly explain the characteristic of Dynamic Programming.

(b) Use Dynamic Programmed to find the value of

Maximum $Z = y_1 + y_2 + y_3$

Subject to the constraints $y_1 + y_2 + y_3 = 5$

$y_1, y_2, y_3 \geq 0$

(OR)

14 (a) What are the steps involved in construction of a state-transition matrix.

(b) Test whether the markov chain having the following transition matrix in regular and cryodic. When $x$ represents some positive $P_{ij}$ value.

15 (a) A decision problem has been expressed in the following pay off table.

(i) What is the minimum pay off action?

(ii) What is the minimum opportunity loss function?

<table>
<thead>
<tr>
<th>Activity</th>
<th>Out Come</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>I</td>
</tr>
<tr>
<td>A</td>
<td>10</td>
</tr>
<tr>
<td>B</td>
<td>30</td>
</tr>
<tr>
<td>C</td>
<td>40</td>
</tr>
</tbody>
</table>

(i) $\text{Åc} \iota\text{ÊÅ} \text{Èy} $

(ii) $\text{Åc} \iota\text{ÊÅ} \text{Èy} $
(OR)

(b) Explain EOL.
EOL $\alpha\epsilon\zeta\iota$.

**SECTION – C**  \(5 \times 12 = 60\)

16 (a) Find the optimum integer solution to the all integer programming problem.
Maximize $Z = x_1 + x_2$
Subject to
\begin{align*}
3x_1 + 2x_2 & \leq 1 \\
x_2 & \leq 5 \\
& x_1, x_2 \geq 0 \text{ and all integer}
\end{align*}
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Subject to the constraints
\[ x_1 + x_2 + x_3 = 15 \]
\[ 2x_1 - x_2 + 2x_3 = 20 \]
\[ x_1, x_2, x_3 \geq 0 \]

\[ Z = 4x_1^2 + 2x_2^2 + x_3^2 - 4x_1x_2 \]
\[ x_1, x_2, x_3 = 15 \]
\[ 2x_1 - x_2 + 2x_3 = 20 \]
\[ x_1, x_2, x_3 \geq 0 \]

18 (a) Use Dynamic Programming to show that
\[ Z = P_1 \log P_1 + P_2 \log P_2 + \ldots + P_n \log P_n \]
Subject to the constraints
\[ P_1 + P_2 + P_3 + \ldots + P_n = 1 \text{ and } P_j \geq 0 \text{ (} j = 1, 2, 3, \ldots, n \text{)} \]
is minimum where \( P_1 = P_2 = \ldots = P_n = \frac{1}{n} \)

(OR)

(b) Divide a positive quantity \( C \) into ‘\( n \)’ parts in such a way that their products is a maximum.

\[ ‘c’ \geq \frac{1}{n^2} \text{ Õ} åi, \text{ ‘} n \text{’} \text{ Õ} ÆåìÕìÜÊÀî, \text{ À¢Ã¢.} \]

19 (a) Define statimay distribution. Obtain the limiting distribution of the three – state markov chain with transition probability matrix.
\[ P = \begin{bmatrix} 0.5 & 0.3 & 0.2 \\ 0.2 & 0.4 & 0.4 \\ 0.1 & 0.5 & 0.4 \end{bmatrix} \]

\[ \text{‘} c‘ \geq \frac{1}{n^2} \text{ Õ} ÆåìÕìÜÊÀî, \text{ ‘} n \text{’} \text{ Õ} ÆåìÕìÜÊÀî, \text{ À¢Ã¢.} \]

(OR)

(b) Obtain \( P^n \) for the following transition probability matrix
\[ P = \begin{bmatrix} 1-a & a \\ b & 1-b \end{bmatrix}, \quad \text{0} < a, \quad \text{b} < 1 \]

\[ P = \begin{bmatrix} 1-a & a \\ b & 1-b \end{bmatrix}, \quad \text{0} < a, \quad \text{b} < 1 \]

20 (a) The Estimated sales of proposed types of perfumes are as under

<table>
<thead>
<tr>
<th>Types of Perfumes</th>
<th>Estimated level of sales (Units)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rs.20,000</td>
<td>Rs.10,000</td>
</tr>
</tbody>
</table>
(i) For each of the following decisions, state the optimal action and specify the value leading to its section: (a) Maximin (b) Maximax (c) Laplace (d) Minimax regret

(ii) What will be the optimal act if the pay off entries represent the costs instead of sales?

<table>
<thead>
<tr>
<th>$A$</th>
<th>$25$</th>
<th>$15$</th>
<th>$10$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$B$</td>
<td>$40$</td>
<td>$20$</td>
<td>$5$</td>
</tr>
<tr>
<td>$C$</td>
<td>$60$</td>
<td>$25$</td>
<td>$5$</td>
</tr>
</tbody>
</table>

(OR)

(b) Consider the following pay off (profit) matrix.

<table>
<thead>
<tr>
<th>$\theta_1$</th>
<th>$\theta_2$</th>
<th>$\theta_3$</th>
<th>$\theta_4$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$a_1$</td>
<td>5</td>
<td>10</td>
<td>18</td>
</tr>
<tr>
<td>$a_2$</td>
<td>8</td>
<td>7</td>
<td>8</td>
</tr>
<tr>
<td>$a_3$</td>
<td>21</td>
<td>18</td>
<td>12</td>
</tr>
<tr>
<td>$a_4$</td>
<td>30</td>
<td>22</td>
<td>19</td>
</tr>
</tbody>
</table>

Solve this using Hurlicj Criterion with $\alpha = 0.75$. 

<table>
<thead>
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<td>22</td>
<td>19</td>
</tr>
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