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STRUCTURE OF COURSE OUTCOMES
FOR
B.A./B.SC. (SIX SEMESTER PROGRAMME)
SUBJECT: MATHEMATICS

Shri Lal Bahadur Shastri Degree College, Gonda

Department of Mathematics

NATIONAL EDUCATION POLICY-2020

PROGRAM OUTCOME AND COURSE OUTCOME

FOR

B.SC. (SIX SEMESTER PROGRAMME)

SUBJECT: MATHEMATICS

Programme Outcomes

A Bachelor of Science (B.Sc.) in Mathematics can open the door to a range of benefits and career opportunities. Here are some key advantages:

1. **Analytical Skills**: Mathematics develops strong analytical and problem-solving skills. You'll learn how to approach complex problems, identify patterns, and use logical reasoning—skills that are highly valued in many fields.
2. **Diverse Career Options**: Graduates can pursue careers in various industries including finance, technology, engineering, data analysis, education, and research. Fields such as actuarial science, statistical analysis, and cryptography often require a strong mathematics background.
3. **Foundation for Advanced Studies**: B.Sc in Mathematics provides a solid foundation for advanced studies. If you're interested in further education, such as a Master's or Ph.D, in mathematics or related fields (e.g., statistics, computer science, or economics), this degree is a strong starting point.
4. **High Demand and Job Stability**: Mathematical skills are in high demand in many sectors. For instance, data analysis and quantitative roles are crucial for many companies, leading to job stability and potentially high salaries.
5. **Versatile Skill Set**: The skills gained from a mathematics degree are applicable in a wide range of jobs and industries. This versatility can make it easier to pivot to different careers or industries if your interests or the job market changes.
6. **Problem-Solving Expertise**: Mathematics emphasizes logical thinking and problem-solving. These skills are valuable in everyday life as well as in various professions, from engineering to economics.
7. **Research Opportunities**: Mathematics is a field with a rich tradition of research and discovery. If students are interested in pushing the boundaries of knowledge, a B.Sc in Mathematics can be a gateway to research positions in academia or industry.
8. **Competitive Edge**: The rigorous training in mathematics can give students a competitive edge in the job market. Employers often value the ability to think critically and solve complex problems.

9. **Teaching and Academia**: For students passionate about teaching, a B.Sc in Mathematics can be a stepping stone to becoming a teacher or professor. It can also lead to opportunities in educational policy or curriculum development.
10. **Quantitative Literacy**: Students will gain a strong understanding of quantitative methods and data interpretation, which are increasingly important in a data-driven world.

In summary, B.Sc. in Mathematics equips students with a versatile skill set that can be applied to numerous fields, offers opportunities for further education, and provides a foundation for a range of rewarding careers.

Course Outcomes

B.A./B.Sc.I (SEMESTER-I), PAPER- I

DIFFERENTIAL CALCULUS & INTEGRAL CALCULUS

Course Code: B030101T	**Credits: 4** **Max. Marks: 25+75**	**Core Compulsory / Elective**
Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P: 4-0-0		**Course Title: DIFFERENTIAL CALCULUS & INTEGRALCALCULUS**

Course outcomes:

CO1: The program outcome is to give foundation knowledge for the students to understand basics of mathematics including applied aspect for developing enhanced quantitative skills and pursuing higher mathematics and research as well.

CO2: By the time students complete the course they will have wide ranging application of thesubject and have the knowledge of real valued functions along with sequence and series. They will also be able to know about convergence of sequence and series. Also, they have knowledge about curvature, envelope and evolutes and trace curve in polar curves, Cartesian curves as well as parametric curves.

CO3: The main objective of the course is to equip the student with necessary analytic and technical skills. By applying the principles of integral he learns to solve a variety of practical problems in science and engineering.

CO4: The student is equipped with standard concepts and tools at an intermediate to advance level that will serve him well towards taking more advance level course in mathematics.

B.A./B.Sc.I (SEMESTER-I), PAPER- II

PRACTICAL

Course Code:B030102P	Credits: 2 Max. Marks: 25+75	Core Compulsory / Elective
Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P: 0-0-4		Course Title: PRACTICAL

Course outcomes:

CO1: The main objective of the course is to equip the student to plot the different graph and solve the different types of equations by plotting the graph using different computer software such as SageMath/Mathematica/MATLAB /Maple /Scilab/ etc.

CO2. After completion of this course student would be able to know the convergence of sequences through plotting.

CO3. Student would be able to verify Bolzano-Weierstrass theorem through plotting the sequence.

CO4. Student would be able to verify cauchy's root test by plotting n^{th} roots and Ratio test by plotting the ratio of n^{th} and $(n+1)^{th}$ term.

B.A./B.Sc.I (SEMESTER-II), PAPER- I

MATRICES AND DIFFERENTIAL EQUATIONS & GEOMETRY

Course Code: B030201T	Credits: 4 Max. Marks: 25+75	Core Compulsory / Elective
Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P: 4-0-0		Course Title: MATRICES AND DIFFERENTIAL EQUATIONS& GEOMETRY

Course outcomes:

CO1: The subjects of the course are designed in such a way that they focus on developing mathematical skills in matrices, differential equation and geometry from basic level to depth of knowledge.

CO2: The student will be able to find the rank, eigen values of matrices and study the linear homogeneous and non-homogeneous equations. The course in differential equation intends to develop problem solving skills for solving various types of differential equations.

CO3: The students will be capable of learn and visualize the fundamental ideas about coordinate geometry and learn to describe some of the surfaces by using analytical geometry.

CO4: On successful completion of the course students have gained knowledge about regular geometrical figures and their properties. They have the foundation for higher course in Geometry.

B.A./B.Sc.I (SEMESTER-II), PAPER- II

PRACTICAL

Course Code: **B030202P**	**Credits: 2 Max. Marks: 25+75**	**Core Compulsory / Elective**
Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P: 0-0-4	**Course Title: PRACTICAL**	

Course outcomes:

CO1: The objective of the course is to familiarize the students to use mathematical softwares such as SageMath/ Mathematica / MATLAB /Maple /Scilab/ etc.

CO2: After completion of course students would be able to perform various operation related to matrices such as addition, multiplication, finding inverse, and finding Eigen-values, Eigen-vectors.

CO3: Students would be able to trace complex number, trigonometric function, conics andcoinicoids.

CO4: Students would be able to visualize the solution of ordinary differential equation

B.A./B.Sc.II (SEMESTER-III), PAPER- I

ALGEBRA & MATHEMATICAL METHODS

Course Code: B030301T	**Credits: 4** **Max. Marks: 25+75**	**Core Compulsory / Elective**
Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P: 4-0-0	**Course Title: ALGEBRA & MATHEMATICAL METHODS**	

Course outcomes:

CO1: Group theory is one of the building blocks of modern algebra. Objective of this course is to introduce students to basic concepts of Group theory, Ring theory and their properties.**CO2:** A student learning this course gets a concept of Group, Ring, Integral Domain and theirproperties. This course will lead the student to basic course in advanced mathematics particularly in Algebra.

CO3: The course gives emphasis to enhance students' knowledge of functions of two variables, Laplace Transforms, Fourier Transforms and series.

CO4: On successful completion of the course students would have acquire knowledge about higher different mathematical methods and will help him in going for higher studies and research**.**

B.A./B.Sc.II (SEMESTER-III), PAPER- II

PRACTICAL

Course Code: B030302P	**Credits: 2 Max. Marks: 25+75**	**Core Compulsory / Elective**
Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P: 0-0-4	**Course Title: PRACTICAL**	

Course outcomes:

CO1: The objective of the course is to familiarize the students to use mathematical softwares such as SageMath/ Mathematica / MATLAB /Maple /Scilab/ etc.

CO2: After completion of course students would be able to visualize important properties related to Group and Cyclic group.

CO3: The course will enable the students to solve problems of continuity and differentiability of function of two variables, Maxima and Minima, Laplace transforms and inverse Laplace transforms.

CO4: Students would be able to approximate the expansion of the function of two variables by Taylor's Theorem and plot the outputs.

B.A./B.Sc.II (SEMESTER-IV), PAPER- I

DIFFERENTIAL EQUATIONS & MECHANICS

Course Code: B030401T	**Credits: 4 Max. Marks: 25+75**	**Core Compulsory / Elective**
Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P: 4-0-0	**Course Title: DIFFERENTIAL EQUATIONS & MECHANICS**	

Course outcomes:

CO1: The objective of this course is to familiarize the students with various methods of solving differential equations, partial differential equations of first order and second order and to have qualitative applications.

CO2: A student doing this course is able to solve differential equations and is able to model problems in nature using ordinary differential equations. After completing this course, a student will be able to take more courses on wave equation, heat equation, diffusion equation, gas dynamics, non linear evolution equation etc. These entire courses are important in engineering and industrial applications for solving boundary value problems.

CO3: The object of the course is to give students knowledge of basic mechanics such as simple harmonic motion, motion under other laws and forces.

CO4: The student, after completing the course can go for higher quality problems in mechanics such as hydrodynamics. This will be helpful in getting employment in industry.

B.A./B.Sc.II (SEMESTER-IV), PAPER- II

PRACTICAL

Course Code: B030402P	**Credits: 2 Max. Marks:** 25+75	**Core Compulsory / Elective**
Total No. of Lectures-Tutorials-Practical (in hours per week): **L-T-P: 0-0-4**		**Course Title: PRACTICAL**

Course outcomes:

CO1: The objective of the course is to familiarize the students to use mathematical softwares such as SageMath/ Mathematica / MATLAB /Maple /Scilab/ etc.

CO2: This course will enable the students to visualize the solution of first order partial differential equation.

CO3: After completion of course students will be capable of solving second order ordinary differential equation such as Legendre and Bessel differential equation.

CO4: This course will enable the students to visualize the solution related to the problems of Kinematics, SHM, Resisting medium and Central orbit.

B.A./B.Sc.III (SEMESTER-V), PAPER- I

GROUP AND RING THEORY &LINEAR ALGEBRA

Course Code: **B030501T**	**Credits: 4 Max. Marks: 25+75**	**Core Compulsory / Elective**
Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P: 4-0-0	**Course Title: GROUP AND RING THEORY &LINEAR ALGEBRA**	

Course outcomes:

CO1: Objective of this course is to sustain the students in Abtract Algebra of almost Advanced Level.

CO2: Liner algebra is a basic course in almost all branches of science. The objective of this course isto introduce a student to the basics of linear algebra and some of its applications.

CO3: After successful completion of course students will enable themselves to knowledge of Orthogonal set, Orthonormal set and Bilinear and Quadratic forms.

CO4: Student will use this knowledge in computer science, finance mathematics, industrial mathematics and Bio mathematics. After completion of this course students will appreciate its interdisciplinary nature.

B.A./B.Sc.III (SEMESTER-V), PAPER- II(i)

NUMBER THEORY & GAME THEORY

Course Code: **B030502T**	**Credits: 4 Max. Marks: 25+75**	**Core Compulsory / Elective**
Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P: 4-0-0	**Course Title: NUMBER THEORY & GAME THEORY**	

Course outcomes:

CO1: Upon successful completion, students will have the knowledge and skills to solve problemsin elementary number theory and also apply elementary number theory to cryptography.

CO2: This course provides an introduction to Game Theory. Game Theory is a mathematical framework which makes possible the analysis of the decision making process of interdependent subjects. It is aimed at explaining and predicting how individuals behave in a specific strategic situation, and therefore help improve decision making.

CO3: A situation is strategic if the outcome of a decision problem depends on the choices of more than one person. Most decision problems in real life are strategic.

CO4: Students are enable to use concept of Game Theory in Real-World problems and Case-Studies.

B.A./B.Sc.III (SEMESTER-V), PAPER- II(ii)

GRAPH THEORY & DISCRETE MATHEMATICS

CourseCode: **B030503T**	**Credits: 4** **Max. Marks: 25+75**	**Core Compulsory / Elective**
Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P: 4-0-0	**Course Title: GRAPH THEORY & DISCRETE MATHEMATICS**	

Course outcomes:

CO1: Upon successful completion, students will have the knowledge of various types of graphs, their terminology and applications.

CO2: After Successful completion of this course students will be able to understand the isomorphismand homomorphism of graphs. This course covers the basic concepts of graphs used in computer science and other disciplines. The topics include path, circuits, adjacency matrix, tree, coloring.. After successful completion of this course the student will have the knowledge of graph coloring, color problem, vertex coloring.

CO3: After successful completion, students will have the knowledge of Logic gates, Karnaugh maps and skills to proof by using truth tables. After Successful completion of this course students will be able to apply the basics of the automation theory, transition function and table.

CO4: This course covers the basic concepts of discrete mathematics used in computer science and other disciplines that involve formal reasoning. The topics include logic, counting, relations, hasse diagram and Boolean algebra. After successful completion of this course the student will have the knowledge in Mathematical reasoning, combinatorial analysis, discrete structures and Applications.

B.A./B.Sc.III (SEMESTER-V), PAPER- II(iii)

DIFFERENTIAL GEOMETRY & TENSOR ANALYSIS

CourseCode: **B030504T**	**Credits: 4** **Max. Marks: 25+75**	**Core Compulsory / Elective**
Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P: 4-0-0	**Course Title: DIFFERENTIAL GEOMETRY & TENSOR ANALYSIS**	

Course outcomes:

CO1: After Successful completion of this course, students should be able to determine and calculate curvature of curves in different titles of Space.

CO2: This course covers the Local theory of Curves, Local theory of surfaces, Geodesics, Geodesics curvature, Geodesic polars, Curvature of curves on surfaces, Gaussian curvature, Normal curvature etc.

CO3: After Successful completion of this course, students should have the knowledge of tensor algebra, different types of tensors, Riemannian space, Ricci tensor, Einstein space and Einstein tensor etc.

CO4: This course enables students to make basic platform for higher studies and research in Geometry of diffeent type.

B.A./B.Sc.III (SEMESTER-V), PAPER- III

PRACTICAL

Course Code: **B030505P**	**Credits: 2 Max. Marks: 25+75**	**Core Compulsory / Elective**
Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P: 0-0-4	**Course Title: PRACTICAL**	

Course outcomes: This course will enable the students to:

CO1: Visualize the basic concepts of vector spaces and their properties.

CO2: Employ the row echelon form in a number of applications to solve numerical problems.

CO3: Familiarize the students with suitable tools of mathematical software to handle issues and problems in Linear Algebra , Group and Rings.

CO4: Represent the outputs of programs visually in terms of well formatted text and plots.

B.A./B.Sc.III (SEMESTER-V), PAPER- IV

PROJECT-I

Course Code: B030506R	Credits: 3 Max. Marks: 25+75	Core Compulsory / Elective
Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P: 0-0-6	Course Title: PROJECT -I	

Course outcomes:

After successful completion of project work, the student will gain basic platform for independentand critical thinking and confidence for completing any assignment.

B.A./B.Sc.III (SEMESTER-VI), PAPER- I

METRIC SPACES & COMPLEX ANALYSIS

Course Code: B030601T	Credits: 4 Max. Marks: 25+75	Core Compulsory / Elective
Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P: 4-0-0	Course Title: METRIC SPACES & COMPLEX ANALYSIS	

Course outcomes:

CO1: The course is aimed at exposing the students to foundations of analysis which will be useful in understanding various physical phenomena and gives the student the foundation in mathematics.

CO2: After completion of this course the student will have rigorous and deeper understanding of fundamental concepts in Mathematics. This will be helpful to the student in understanding pure mathematics and in research.

CO3: Students will be able to know the concepts of metric space, basic concepts and developments of complex analysis which will prepare the students to take up further applications in the relevant fields.

CO4: The course enables the students the basics of analytic function and contour integration for further application in higher studies.

B.A./B.Sc.III (SEMESTER-VI), PAPER- II

NUMERICAL ANALYSIS & OPERATION RESEARCH

Course Code: B030602T	Credits: 4 Max. Marks: 25+75	Core Compulsory / Elective
Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P: 4-0-0	**Course Title: NUMERICAL ANALYSIS & OPERATIONRESEARCH**	

Course outcomes:

CO1: The aim of this course is to teach the students the application of various numerical techniquefor variety of problems occurring in daily life. At the end of the course the student will be able to understand the basic concept of Numerical Analysis and to solve algebraic and differential equation.

CO2: The main outcome will be that students will be able to handle problems and finding approximated solution. Later he can opt for advance course in Numerical Analysis in higherMathematics.

CO3: The student will be able to solve various problems based on convex sets and linear programming. After successful completion of this paper will enable the students to apply the basic concepts of transportation problems and its related problems to apply in further concepts and application of operation research.

CO4: After successful completion of this course students have basic knowledge of Numerical Analysis and Operations Research for higher study and Research.

B.A./B.Sc.III (SEMESTER-VI), PAPER- III

PRACTICAL

Course Code: B030603P	Credits: 2 Max. Marks: 25+75	Core Compulsory / Elective
Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P: 0-0-4	**Course Title: PRACTICAL**	

Course outcomes:

The main objective of the course is to equip the student to solve the transcendental and algebraic equations, system of linear equations, Interpolation, Numerical Integration, method of findingEigenvalue by Power method, ordinary differential equations, ordinary difference equations and Linear Programming Problem.

B.A./B.Sc.III (SEMESTER-V), PAPER- IV

PROJECT-II

Course Code: B030603P	Credits: 2 Max. Marks: 25+75	Core Compulsory / Elective
Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P: 0-0-6	Course Title: PROJECT -II	
Course outcomes: After successful completion of project work, the student will gain basic platform for independentand critical thinking and confidence for completing any assignment.		