DEPARTMENT OF MATHEMATICS

CURRICULUM PLANNING AND IMPLEMENTATION

Even Semester (2019-20)

(P.G. Classes)

CURRICULUM PLANNING AND IMPLEMENTATION

Department: Mathematics
Name of the faculty Member: Ms. Nitika Chugh
Course Name: Real Analysis II
Class: M. Sc.
Semester: II
Availability Timings: 9.00 AM to 3.00 PM
E-mail: nitika.nitj@gmail.com

Course Objectives:

The aim of the course is to demonstrate theoretical knowledge and have practical skills in the subject of advanced real analysis. Demonstrate an ability to initiate and sustain in-depth research relevant to real analysis. Furthermore, in this course the students will develop a proper understanding of measurable functions, measures and the Lebesgue integral. Given these concepts they will consider various concepts of convergence of measurable functions and the convergence of the corresponding integrals, changes of measures and spaces of integrable function.

Program Learning Outcomes:

(Knowledge and understanding, Intellectual skills, practical skills, general skills)
Learning outcomes:

A. **Knowledge and Understanding:**
Students will know
- The theories and concepts used in the real analysis.

- Identify the steps required to carry out a piece of research on a topic within real analysis.
- Recognize the contribution and impacts of real analysis in different areas of science.

B. Intellectual(cognitive/Analytical) skills:

- Apply appropriate theories, principles and concepts relevant to the real analysis.
- Assess and evaluate the literature within real analysis.
- Demonstrate an appropriate judgment in selecting and presenting information using various methods relevant to real analysis.

C. Practical skills:

- Plan and design practical activities using techniques and procedures appropriate to real analysis.
- Plan and design a piece of independent research using real analysis media and techniques.

D. General skills:

- Use appropriate effective written and oral communication learning relevant to the topics in the course of real analysis.
- Work effectively as part of a group, involving leadership, group dynamics and interpersonal skills such as listening, negotiation and persuasion relevant to these topics.
- Deal with problems relevant to real analysis topics using ideas and techniques some of which are at the forefront of the discipline.
- Think independently and develop the ability to self appraise and reflect on scientific data Arabic and in English relevant to real analysis.

Detailed Course content available at www.gndu.ac.in

Teaching Outline:

Section	Lecturewise Breakage	No.of Lectures	Mode of Delivery*	Students Role*
A	Uniform convergence	5	Lecture	Participation/ Discussion
	Uniform convergence and integration,	4	Lecture	Participation/ Discussion

	differentiations			
	Equi continuous families of function	3	Lecture	Participation/ Discussion
	Arzela's theorem	2	Lecture	Participation/ Discussion
	Weierstrass Approximation theorem	2	Lecture	Participation/ Discussion
B	Outer and lebesgue measure	4	Lecture	Participation/ Discussion
	Properties of measurable set	5	Lecture	Participation/ Discussion
	Non-measurable set	5	Lecture	Participation/ Discussion
	Measurable functions	6	Lecture	Participation/ Discussion
C	Characteristics, step and simple function	5	Lecture	Participation/ Discussion
	Little wood's three principle	5	Lecture	Participation/ Discussion
	Lebesgue integral of bounded function	4	Lecture	Participation/ Discussion
	Comparison of Riemann and lebesgue integral	4	Lecture	Participation/ Discussion
	Integral of a non negative function, general lebesgue integral	6	Lecture	Participation/ Discussion
	Convergence in measure	3	Lecture	Participation/ Discussion
D	Differentiation of monotone function	5	Lecture	Participation/ Discussion
	Differentiation of integral	4	Lecture	Participation/ Discussion
	Absolute continuity	4	Lecture	Participation/ Discussion

Teaching methods:

- Lectures: Six per week
- Student Seminars: two per week

- Assignments: The students will be asked to read the textbook in advance and write articles on given topics
- PowerPoint Presentations
- Quiz
- Group Discussion

Modes Of Assessment	**Minimum Score Required (to Qualify for the next Exam /Class)**	
Continuous Internal Evaluation(CIE)		
1.Class Tests(Unit wise)	**40%**	**After Each Unit**
2.Student Seminars		**Every Week**
3.In House Exams	**40%**	**Last week Of March**
End of Semester	**20%**	**Last Week of April**

Reference books:

S.no	**Standard reference books**	**Author**
1	Principles of Mathematical Analysis (3rd edition) McGraw Hill Ltd. Ch.7(7.1-7.27)	Walter Rudin
2	Mathematical Analysis, Wiley Eastern	Malik, S.C.
3	Real Analysis, Macmillan Co. (Ch. 3,4,5 excluding section 2,5)	Royden, H.L.
4	Lebesgue Measure and Integration	Jain, P.K. and Gupta, V.P.
5	Introduction to Measure Theory, Van Nosh and Reinhold Company	Barra, G De

Attendance Policy:

Lecture attendance is mandatory. Students are expected to maintain 75% attendance of the total lectures delivered, failing which they will be detained from appearing in university exams.

CURRICULUM PLANNING AND IMPLEMENTATION

Department: Mathematics
Name of the faculty Member: Dr. Santokh Singh Minhas
Course Name: Algebra II
Class: M.Sc
Semester: II
Availability Timings: 9.00 AM to 3.00 PM
E-mail: santokhmathlkc@gmail.com

Course Objectives:

This course aims to provide a first approach to the subject of algebra, which is one of the basic pillars of modern mathematics. The focus of the course will be the study of certain structures called groups, rings, fields and some related structures. Abstract algebra gives to student a good mathematical maturity and enables to build mathematical thinking and skill.

Program Learning Outcomes:

(Knowledge and understanding, Intellectual skills, general skills,) Learning outcomes:

E. Knowledge and Understanding:

- Students will be introduced to and have knowledge of many mathematical concepts studied in abstract mathematics such as permutation groups, factor groups and Abelian groups.
- Students will see and understand the connection and transition between previously studied mathematics and more advanced mathematics.

- The students will actively participate in the transition of important concepts such homeomorphisms & isomorphisms from discrete mathematics to advanced abstract mathematics.
- Students will gain experience and confidence in proving theorems. A blended teaching method will be used requiring the students to prove theorems give the student the experience and knowledge.

F. Intellectual(cognitive/Analytical) skills:

Students will be

- Able to employ the concepts and methods described in the syllabus.
- Acquire communication and organizational skills, including effective written communication in their weekly assignments.
- Able to follow complex logical arguments and develop modest logical arguments.

G. General skills:

- Communicate with other positively with problems relevant to problems in modern algebra.
- Use organizational skills (including task and time management) relevant to modern algebra individually and in group situation.
- Solve problems relevant to modern algebra.

Detailed Course content available at www.gndu.ac.in

Teaching Outline:

Section	Lecturewise Breakage	No.of Lectures	Mode of Delivery*	Students Role*
A	The field of Quotients of an integral domain	6	Lecture	Participation/ Discussion
	Principal Ideal domains, Euclidean Rings	5	Lecture	Participation/ Discussion
	The ring of Gaussian Integers, Unique Factorization domains, Polynomial Rings	7	Lecture	Participation/ Discussion
	Gauss's theorem and irreducibility of a polynomial	5	Lecture	Participation/ Discussion
B	Finite and Infinite, Simple and Algebraic	6	Lecture	Participation/ Discussion

	Extensions			
	Splitting fields	4	Lecture	Participation/ Discussion
	Existence and uniqueness theorem of extension fields	4	Lecture	Participation/ Discussion
	Separable and inseparable extensions	5	Lecture	Participation/ Discussion
	Perfect fields, finite fields	4	Lecture	Participation/ Discussion
C	Existence of GF(pn)	2	Lecture	Participation/ Discussion
	Construction with Straight edge ruler and compass	4	Lecture	Participation/ Discussion
	Galois Theory: Group of automorphisms of a field.	5	Lecture	Participation/ Discussion
	Normal extensions and Fundamental Theorem of Galois theory	4	Lecture	Participation/ Discussion
	Symmetric rational functions, Solvability by radicals	3	Lecture	Participation/ Discussion
D	Modules, Cyclic Modules	6	Lecture	Participation/ Discussion
	simple modules, Free Modules	4	Lecture	Participation/ Discussion
	Fundamental structure theorem for finitely generated modules over a P.I.D. (Statement only)	5	Lecture	Participation/ Discussion

Teaching methods:

Lectures: Six per week
Student Seminars: two per week

Assignments: The students will be asked to read the textbook in advance and write articles on given topics
PowerPoint Presentations
Quiz
Group Discussion

Modes Of Assessment	**Minimum Score Required (to Qualify for the next Exam /Class)**	
Continuous Internal Evaluation(CIE)		
1.Class Tests(Unit wise)	**40%**	**After Each Unit**
2.Student Seminars		**Every Week**
3.In House Exams	**40%**	**Last week Of March**
End of Semester	**20%**	**Last Week of April**

Reference books:

S.no	**Standard reference books**	**Author**
1	Topics in Algebra, Willey Eastern 1975	Herstein, I.N.
2	An introduction to Abstract Algebra	Fraleigh, J.B.
3	Modern Algebra	Surjit Singh
4	Basic Abstract Algebra(1997), Ch-14(Sec, 1-5)	Bhattacharya, P.B.,Jain, S.K. & Nagpal S.R.

Attendance Policy:
Lecture attendance is mandatory. Students are expected to maintain 75% attendance of the total lectures delivered, failing which they will be detained from appearing in university exams.

CURRICULUM PLANNING AND IMPLEMENTATION

Department: Mathematics
Name of the faculty Member: Dr. Dinkar Sharma
Course Name: Mechanics II
Class: M.Sc
Semester: II
Availability Timings: 9.00 AM to 3.00 PM
E-mail: dinkarmathlkc@gmail.com

Course Objectives:

Mechanics is the study of the physics of motion and how it related to applied forces. It lays the foundation of understanding the world around us through the how and why of motion. The second module that covers calculus based mechanics. Calculus of Variations deals with optimization problems where the variables, instead of being finite dimensional as in ordinary calculus, are functions. This course treats the foundations of calculus of variations and gives examples on some (classical and modern) applications within physics and engineering science.

Program Learning Outcomes:

(Knowledge and understanding, Intellectual skills, practical skills)
Learning outcomes:

H. Knowledge and Understanding:

- Define the characteristics and calculate the magnitude of selected mechanical properties of materials.

- Describe the basic concepts and principles and perform relevant calculations with respect to the mechanical properties of materials as they relate to problems of strength and stability of structures and mechanical components.

I. Intellectual(cognitive/Analytical) skills:

In order to pass the course the student should be able to

- Give an account of the foundations of calculus of variations and of its applications in mathematics and physics.
- Describe the brachistochrone problem mathematically and solve it.
- Solve isoperimetric problems of standard type.
- solve simple initial and boundary value problems by using several variable calculus;
- Formulate maximum principles for various equations and derive consequences.
- Formulate important results and theorems covered by the course.
- Use the theory, methods and techniques of the course to solve problems.

J. Practical skills:

- Relative motion. Inertial and non inertial reference frames.
- Parameters defining the motion of mechanical systems and their degrees of freedom.
- Study of the interaction of forces between solids in mechanical systems.
- Centre of mass and inertia tensor of mechanical systems.
- Application of the vector theorems of mechanics and interpretation of their results.
- Newton's laws of motion and conservation principles.
- Introduction to analytical mechanics as a systematic tool for problem solving..

Detailed Course content available at www.gndu.ac.in

Teaching Outline:

Section	Lecturewise Breakage	No. of Lectures	Mode of Delivery*	Students Role*
A	General motion of a rigid body	3	Lecture	Participation Discussion
	Angular momentum of a system	3	Lecture	Participation Discussion
	Use of centroid, moving origins, impulsive forces	4	Lecture	Participation Discussion
	Problems in two-dimensional rigid body motion	3	Lecture	Participation Discussion
	law of conservation of Angular momentum, illustrating the laws of motion	4	Lecture	Participation Discussion
	Law of conservation of energy, Impulsive motion	5	Lecture	Participation Discussion
B	Euler's dynamical equations for the motion of a rigid body about a fixed point, further properties of rigid body motion under no forces.	6	Lecture	Participation Discussion
	Problems on general three-dimensional rigid body motion.	3	Lecture	Participation Discussion
C	Generalised co-ordinates and velocities Virtual work, generalized forces.	4	Lecture	Participation Discussion
	Lagrange's equations for a holonomic system and their applications to small oscillation. Lagrange's equations for impulsive forces.	5	Lecture	Participation Discussion

	Kinetic energy as a quadratic function of velocities. Equilibrium configurations for conservative holonomic dynamical systems.	5	Lecture	Participation Discussion
	Theory of small oscillations of conservative holonomic dynamical systems	5	Lecture	Participation Discussion
D	Linear functional, Extremal. Euler's - Lagrange's equations of single independent and single dependent variable.	6	Lecture	Participation Discussion
	Brachistochrone problem, Extension of the variational method.	6	Lecture	Participation Discussion
	Hamilton's Principle, Principle of Least action. Distinctions between Hamilton Principle and the Principle of Least Action.	7	Lecture	Participation Discussion
	Rayleigh-Ritz Method,	6	Lecture	Participation Discussion

Teaching methods:

- Lectures: Six per week
- Student Seminars: two per week
- Assignments: The students will be asked to read the textbook in advance and write articles on given topics
- PowerPoint Presentations
- Quiz
- Group Discussion

Reference books:

S.no	Standard reference books	Author
1	Text Book of Dynamics	Chorlton, F.
2	Tensor Analysis	Elssgists, L.
3	Calculus of Variation with Application (PHI Learning Pvt, Ltd)	Gupta

Modes Of Assessment	Minimum Score Required (to Qualify for the next Exam /Class)	
Continuous Internal Evaluation(CIE)		
1.Class Tests(Unit wise)	**40%**	**After Each Unit**
2.Student Seminars		**Every Week**
3.In House Exams	**40%**	**Last week Of March**
End of Semester	**20%**	**Last Week of April**

Attendance Policy:

Lecture attendance is mandatory. Students are expected to maintain 75% attendance of the total lectures delivered, failing which they will be detained from appearing in university exams.

CURRICULUM PLANNING AND IMPLEMENTATION

Department: Mathematics
Name of the faculty Member: Prof.Palwinder Singh
Course Name: Differential and Integral Equations
Class: M.Sc
Semester: II
Availability Timings: 9.00 AM to 3.00 PM
E-mail: palwindermathlkc@gmail.com

Course Objectives:

The aim of the course is to study integral equations and to know that what is the relationship between the integral equations and ordinary differential equations and how to solve linear and non- linear integral equations by different methods with some problems which give rise to integral equations.

Program Learning Outcomes:
(Knowledge and understanding, Intellectual skills, practical skills)
Learning outcomes:

K. Knowledge and Understanding:

Students will know

- Model with first-order differential equations (DE) and identify initial value problems
- Explore the use of partial differential equations as models for processes of heat transfer, wave propagation, and diffusion.
- Develop essential methods of obtaining solutions of classical partial differential equations.
- Explore the methods of solutions of boundary value problems. Investigate systems of ordinary differential equations.

L. Intellectual(cognitive/Analytical) skills:

- Obtain solutions for ordinary differential equations whose non homogeneous terms include discontinuous functions or distributions.
- Solve classical partial differential equations such as the heat equation, wave equation, Laplace's equation, and Poisson's equation by various methods.
- Obtain solutions for systems of ordinary differential equations using various tools of linear algebra.

M. Practical skills:

- Solve problems in ordinary differential equations, dynamical systems, stability theory, and a number of applications to scientific and engineering problems.
- Demonstrate their ability to write coherent mathematical proofs and scientific arguments needed to communicate the results obtained from differential equation models.

Detailed Course content available at www.gndu.ac.in

Teaching Outline:

Section	Lecturewise Breakage	No.of Lectures	Mode of Delivery*	Students Role*
A	Partial Differential Equations of First Order : origin of first order partial differential equations.	5	Lecture	Participation/ Discussion
	Cauchy problem of first order equations.	4	Lecture	Participation/ Discussion
	Integral surface through a given curve. Surface orthogonal to given system of surfaces.	5	Lecture	Participation/ Discussion
	Non linear p.d.e of first order, Charpit's method	4	Lecture	Participation/ Discussion
	Jacobi's method.	3	Lecture	Participation/ Discussion
	Partial differential equations of the 2nd	4	Lecture	Participation/ Discussion

	order. Origin of 2nd order equations.			
	Linear p.d.e. with constant coefficients and their complete solutions.	3	Lecture	Participation/ Discussion
B	Second order equation with variable coefficient and their classification and reduction to standard form	3	Lecture	Participation/ Discussion
	Solution of linear hyperbolic equation. Non-linear equations of second order	4	Lecture	Participation/ Discussion
	Monge's Method.	3	Lecture	Participation/ Discussion
	Solution of Laplace, wave and diffusion equations by method of separation of variables	3	Lecture	Participation/ Discussion
	Fourier transforms.	3	Lecture	Participation/ Discussion
	Green function for Laplace, waves and diffusion equation	6	Lecture	Participation/ Discussion
C	Integral Equations and algebraic system of linear equations	4	Lecture	Participation/ Discussion
	Volterra Equation of first and second order	4	Lecture	Participation/ Discussion
	Volterra Integral Equations and Linear Differential Equations	5	Lecture	Participation/ Discussion
D	Fredholm Equations, Solution by Method of Successive Approximation	5	Lecture	Participation/ Discussion
	Pincherte-Goursat Kernels	3	Lecture	Participation/ Discussion

	Fredholm Theorem	2	Lecture	Participation/ Discussion

Teaching methods:

Lectures: Six per week
Student Seminars: two per week
Assignments: The students will be asked to read the textbook in advance and write articles on given topics
PowerPoint Presentations
Quiz
Group Discussion

Modes Of Assessment	**Minimum Score Required (to Qualify for the next Exam /Class)**	
Continuous Internal Evaluation(CIE)		
1.Class Tests(Unit wise)	**40%**	**After Each Unit**
2.Student Seminars		**Every Week**
3.In House Exams	**40%**	**Last week of March**
End of Semester	**20%**	**Last Week of April**

Reference books:

S.no	**Standard reference books**	**Author**
1	Integral Equation (Ch. I and II)	Tricomi, F.G.
2	Linear integral equations	Kanwal R,P.
3	Differential Equations	Plaggio
4	Elements of partial differential equations	Sneddon, I.N.
5	Integral Equations	Levitt, W.W.
6	Integral Equations	Mikhlin

Attendance Policy:
Lecture attendance is mandatory. Students are expected to maintain 75% attendance of the total lectures delivered, failing which they will be detained from appearing in university exams.

CURRICULUM PLANNING AND IMPLEMENTATION

Department: Mathematics
Name of the faculty Member: Dr. Harjit Singh
Course Name: Tensors and Differential Geometry
Class: M.SC
Semester: II
Availability Timings: 9.00 AM to 3.00 PM
E-mail: harjitlkc@gmail.com

Course Objectives:
The aim of the course is to provide for the students an introduction to theory of tensors which is a classical subject in multi linear algebra and differential geometry. The course focuses on the basic concept of tensor products of vector spaces and operators, various notions of tensor ranks. Furthermore, this course introduces students to the key concepts and techniques of differential geometry.

Program Learning Outcomes:

(Knowledge and understanding, Intellectual skills, practical skills)
Learning outcomes:

N. Knowledge and Understanding:
Student will know

- Scalar and cross product of vectors in 2 and 3 dimensions represented as differential forms or tensors.
- The vector-valued functions of a real variable and their curves and in turn the geometry of such curves including curvature, torsion and the Serret-Frenet frame and intrinsic geometry,
- Scalar and vector valued functions of 2 and 3 variables and surfaces, and in turn the geometry of surfaces

- The differential ideas of divergence, curl, and the Laplacian along with their physical interpretations, using differential forms or tensors to represent derivative operations.

O. Intellectual (cognitive/Analytical) skills:

- State definitions and theorems and present standard proofs accurately without access to notes/books.
- Perform local calculations in differential geometry accurately (tensor calculus, covariant derivatives, Lie derivatives).
- Calculate curvature tensors for simple space times.
- Derive and solve the geodesic equations for simple space times.

P. Practical skills:

- Apply theory developed in the course to solve unseen problems.
- Integral curves of vector fields and solving differential equations to find such curves.
- The differential ideas of divergence, curl, and the Laplacian along with their physical interpretations, using differential forms or tensors to represent derivative operations,

Detailed Course Contents: Available at www.gndu.ac.in

Teaching Outline:

Section	Lecturewise Breakage	Number of lectures	Mode of Delivery*	Students Role*
A	Tensors	5	Lecture	Participation/ Discussion
	Kronecker delta	3	Lecture	Participation/ Discussion
	Christoffel Symbols	4	Lecture	Participation/ Discussion
	Covariant Differentiation of tensors	6	Lecture	Participation/ Discussion
B	Theory of space curves	4	Lecture	Participation/ Discussion
	Serret-Frenet Formulae	3	Lecture	Participation/

				Discussion
	Contact Between Curves And Surfaces	4	Lecture	Participation/ Discussion
	Locus of centre of curvature	3	Lecture	Participation/ Discussion
	Helices, Spherical curvature	3	Lecture	Participation/ Discussion
	Spherical Indicatrix, Bertrand Curves	5	Lecture	Participation/ Discussion
C	Envelope, Developable Surfaces	5	Lecture	Participation/ Discussion
	Two fundamental forms	4	Lecture	Participation/ Discussion
	Conjugate And Principal Direction, Asymptotic lines	7	Lecture	Participation/ Discussion
	Theorem of Beltrami and Enneper	3	Lecture	Participation/ Discussion
	Mainardi- Codazzi Equations	4	Lecture	Participation/ Discussion
D	Geodesics	7	Lecture	Participation/ Discussion
	Clairaut's Theorem	3	Lecture	Participation/ Discussion
	Gauss Bonnet Theorem	3	Lecture	Participation/ Discussion
	Tissot's Theorem	3	Lecture	Participation/ Discussion

Teaching methods:

- Lectures: Six per week
- Student Seminars: two per week
- Assignments: The students will be asked to read the textbook in advance and write articles on given topics
- PowerPoint Presentations
- Quiz
- Group Discussion

Modes Of Assessment	**Minimum Score Required (to Qualify for the next Exam /Class)**	
Continuous Internal Evaluation(CIE) 1.Class Tests(Unit wise)		
  2.Student Seminars	**40%**	**After each unit**
  3.In House Exams	**40%**	**Last week Of March**
End of Semester	**20%**	**Last Week of April**

Reference books:

S.no	**Standard reference books**	**Author**
1	Vector and Tensor Analysis	Lass, H
2	Tensor Analysis	Shanti Narayan
3	Differential Geometry	Weather burn, C.E
4	Introduction to Differential Geometry	Willmore, TJ
5	Differential Geometry	Bansi Lal

Attendance Policy:

Lecture attendance is mandatory. Students are expected to maintain 75% attendance of the total lectures delivered, failing which they will be detained from appearing in university exams.

CURRICULUM PLANNING AND IMPLEMENTATION

Department: Mathematics
Name of the faculty Member:Dr. Harjit Singh
Course Name: Functional Analysis II
Class: M.Sc
Semester: IV
Availability Timings: 9.00 AM to 3.00 PM
E-mail:

Course Objectives:

Demonstrate theoretical knowledge and have practical skills in the theory of analysis. Demonstrate an ability to initiate and sustain in-depth research relevant to functional analysis. Have an opportunity to put theory into practice via applications of functional analysis on real life problems.

Program Learning Outcomes:
(Knowledge and understanding, Intellectual skills, professional skills, general skills)Learning outcomes:

A. Knowledge and Understanding:

- Summarize the theories and concepts used in the functional analysis.
- Identify the steps required to carry out a piece of research on a topic within functional analysis.
- Recognize the contribution and impacts of functional analysis in applied science.

B. Intellectual (cognitive/Analytical) skills:

- Apply appropriate theories, principles and concepts relevant to the functional analysis.
- Demonstrate a reasoned argument to the solution of familiar and unfamiliar problems relevant to functional analysis.
- Assess and evaluate the literature within functional analysis

C. Professional skills:

- Plan practical activities using techniques and procedures appropriate to functional analysis.
- Execute a piece of independent research using functional analysis media and techniques.

D. General skills:

- Deal with appropriate effective written and oral communication skills relevant to functional analysis.
- Work effectively as a part of group, involving leadership, group dynamics relevant to functional analysis.

Detailed Course content available at www.gndu.ac.in

Teaching Outline:

Unit	Lecture wise Breakage	No. of Lectures	Mode of Delivery*	Students Role*
I	Strong and weak convergence in finite and infinite dimensional normed linear spaces.	4	Lecture	Participation/ Discussion
	Weak convergences in Hilbert spaces	5	Lecture	Participation/ Discussion
	Weakly compact set in Hilbert spaces.	5	Lecture	Participation/ Discussion
II	The adjoint of an operator, self adjoint operators	7	Lecture	Participation/ Discussion
	normal operators, Unitary operators,	3	Lecture	Participation/ Discussion
	Projections on a Hilbert space.	6	Lecture	Participation/ Discussion
III	Eigen- values and Eigen vectors	4	Lecture	Participation/ Discussion
	Spectrum of a bounded linear operator	3	Lecture	Participation/ Discussion
	Spectrum of self-adjoint, positive and Unitry	5	Lecture	Participation/ Discussion

	operators.			
	Spectral Theorem for normal operators	6	Lecture	Participation/ Discussion
IV	Compact Linear Operator on normed spaces, properties of compact linear operators	7	Lecture	Participation/ Discussion
	Spectral properties of compact linear operators.	6		
V	Banach algebras: definitions and simple examples	7	Lecture	Participation/ Discussion
	Regular and singular elements.	5	Lecture	Participation/ Discussion
	Topological divisors of zero	3	Lecture	Participation/ Discussion
	Spectrum of an element of Banach Algebra, formula for spectral radius	3	Lecture	Participation/ Discussion

Teaching methods:

Lectures: Six per week
Student Seminars: two per week
Assignments: The students will be asked to read the textbook in advance and write articles on given topics
PowerPoint Presentations
Quiz
Group Discussion

Modes Of Assessment	**Minimum Score Required (to Qualify for the next Exam /Class)**	
Continuous Internal Evaluation(CIE)		
	40%	**After Each Unit**

1.Class Tests(Unit wise) 2.Student Seminars 3.In House Exams		**Every Week**
	40%	**Last week Of March**
End of Semester Exam	**20%**	**Last Week of April**

Reference books:

S.no	Standard reference books	Author
1	Introduction to Topology and Modern Analysis Ch. X(Sections 56-59), Ch.XI (Sections 61-62), Ch.12(Sections 64-68), McGraw-Hill (1963) International Book Company	Simmons, G.F.
2	Introduction to Functional Analysis with Applications, Ch 8, Sections 8.1-8.3, John Wiley & Sons (1978)	Erwin Kreyszig
3	Functional Analysis, New Age International Limited, 1996	Limaye, Balmohan V.
4	Functional Analysis, New Age International (P), 1995	Jain, P.K., Ahuja, O.P & Khalil Ahmed
5	Functional Analysis, Narosa, 2002	Chandrasekhra Rao, K.
6	A First Course in Functional Analysis, Narosa, 2006	Somasundram, D.

Attendance Policy:

Lecture attendance is mandatory. Students are expected to maintain 75% attendance of the total lectures delivered, failing which they will be detained from appearing in university exams.

CURRICULUM PLANNING AND IMPLEMENTATION

Department: Mathematics
Name of the faculty Member: Dr. Santokh Singh Minhas
Course Name: Operations Research II
Class: M.Sc
Semester: IV
Availability Timings: 9.00 AM to 3.00 PM
E-mail: santokhmathlkc@gmail.com

Course Objectives:

The objectives of this course is to introduce students to the technique of operation research in mining operation, provide students with skills and knowledge of operation research and its applications in mineral industry and introduce students to practical applications of operation research in big mining projects.

Program Learning Outcomes:

(Knowledge and understanding, Intellectual skills, practical skills) Learning outcomes:

Q. Knowledge and Understanding:

The students will be able to

- Explain the meaning of operation research.
- Know the various techniques of operation research.
- Select an optimum solution with profit maximization.
- Apply the techniques used in operation research to solve real life problem.

R. Intellectual(cognitive/Analytical) skills:

Use operation research to:

- Eliminate customers/clients waiting period for service delivery.
- Illustrate how queuing theory can solve problems with inter-arrival and service times exponentially distributed using operation research.
- Solve transportation problems during the allocation of truck to excavators.

S. Practical skills:

- Identify and develop operational research models from the verbal description of the real system.
- Understand the mathematical tools that are needed to solve optimisation problems. Use mathematical software to solve the proposed models.
- Develop a report that describes the model and the solving technique, analyse the results and propose recommendations in language understandable to the decision-making processes in Management Engineering.

Detailed Course content available at www.gndu.ac.in

Teaching Outline:

Unit	Lecturewise Breakage	No. of Lectures	Mode of Delivery *	Students Role*
I	Queueing Theory	4	Lecture	Participation/ Discussion
	Classification of queueing models	5	Lecture	Participation/ Discussion
	Queue model (M/M/1):(∞/FIFO)	4	Lecture	Participation/ Discussion
II	(M/M/1):(N/FIFO)	5	Lecture	Participation/ Discussion
	Birth-Death Process Model	4	Lecture	Participation/ Discussion
	(M/M/C):(∞/FIFO), (M/M/C):(N/FIFO)	5	Lecture	Participation/ Discussion
	(M/M/1):(KIGD)	4	Lecture	Participation/ Discussion
	Power Supply Model	3	Lecture	Participation/ Discussion

III	Inventory Control, Economic order quantity	6	Lecture	Participation/ Discussion
	EOQ problems with price breaks	4	Lecture	Participation/ Discussion
	Multi item deterministic problems	5	Lecture	Participation/ Discussion
IV	Replacement of equipment, falls suddenly	5	Lecture	Participation/ Discussion
	Recruitment and promotion problem	4	Lecture	Participation/ Discussion
	Equipment renewal problem	4	Lecture	Participation/ Discussion
V	Need & methodology of simulation	4	Lecture	Participation/ Discussion
	Simulation models	5	Lecture	Participation/ Discussion
	Monte-carlo Simulation	5	Lecture	Participation/ Discussion
	Simulation of inventory,queueing,maintenance problems	6	Lecture	Participation/ Discussion

Teaching methods:

- Lectures: Six per week
- Student Seminars: two per week
- Assignments: The students will be asked to read the textbook in advance and write articles on given topics
- PowerPoint Presentations
- Quiz
- Group Discussion

Modes Of Assessment	**Minimum Score Required (to Qualify for the next Exam /Class)**	
Continuous Internal Evaluation(CIE)		

1.Class Tests(Unit wise) 2.Student Seminars 3.In House Exams	**40%**	**After Each Unit**
		Every Week
	40%	**Last week Of March**
End of Semester	**20%**	**Last Week of April**

Reference books:

S.no	Standard reference books	Author
1	Mathematical Programming	Handley, G.
2	Mathematical Programming	Kambo, N.S.
3	Operations Research	Panneerselvam, R.
4	Operations Research	Taha, H.A
5	Operations Research	Kanti Sawrup, Gupta, P.K and Manmohan

Attendance Policy:

Lecture attendance is mandatory. Students are expected to maintain 75% attendance of the total lectures delivered, failing which they will be detained from appearing in university exams.

CURRICULUM PLANNING AND IMPLEMENTATION

Department: Mathematics
Name of the faculty Member: Dr. Dinkar Sharma
Course Name: Discrete Mathematics I
Class: M.Sc
Semester: IV
Availability Timings: 9.00 AM to 3.00 PM
E-mail: dinkarmathllkc@gmail.com

Course Objectives:
Throughout the course, students will be expected to demonstrate their understanding of discrete mathematics by being able to do use of mathematically correct terminology and notation, construct correct direct and indirect proofs, and use division into cases in a proof and apply logical reasoning to solve a variety of problems.

Program Learning Outcomes:

(Knowledge and understanding, Intellectual skills, logical skills)
Learning outcomes:

T. **Knowledge and Understanding:**
- Simplify and evaluate basic logic statements including compound statements, implications, inverses, converses.
- Get the knowledge discrete and non-discrete function, graph function, identify one to-one functions, and perform the composition of functions.
- Understanding of how to apply algorithms to problems including searching algorithm, base conversion algorithms and the Euclidean algorithm.
- Express a logic sentence in terms of predicates, quantifiers and logical connectives.

U. **Intellectual(cognitive/Analytical) skills:**

- Solve counting problems involving the multiplication rule, permutation and combination.
- State the definitions of binary relation, reflexive, symmetric, transitive, equivalence relation, equivalence class, class representative and partitions.
- Connection between cardinality of sets and one-to-one correspondences, and be able to prove two sets have the same cardinality.

V. Logical skills:

- Apply rules of inference, tests for validity and methods of proofs including direct and indirect proof forms, proof by contradiction, and proof by cases and mathematical induction.
- Evaluate Boolean functions and simplify expression using the properties of Boolean algebra, apply Boolean algebra to circuits and gating networks.
- Determine if a graph is a binary tree, N-array tree, or not a tree; use the properties of tress to classify trees, identify ancestors, descendants, parents, children and siblings.

Detailed Course content available at www.gndu.ac.in

Teaching Outline:

Unit	Lecturewise Breakage	Number of lectures	Mode of Delivery*	Students Role*
I	Binary relations, Equivalence, partial order relations	4	Lecture	Participation/ Discussion
	Inclusion and exclusion principle	3	Lecture	Participation/ Discussion
	Hasse diagram	2	Lecture	Participation/ Discussion
	Pigeon hole principle	4	Lecture	Participation/ Discussion
II	Basic logical operations	2	Lecture	Participation/ Discussion
	Conditional and biconditional statements	3	Lecture	Participation/ Discussion
	Tautologics , contradiction	3	Lecture	Participation/ Discussion

	quantifiers	4	Lecture	Participation/ Discussion
	Prepositional calculus	4	Lecture	Participation/ Discussion
III	Definition and examples of semi groups and monoids	5	Lecture	Participation/ Discussion
	Homomorphism of semigroups and monoids	4	Lecture	Participation/ Discussion
	Congruence relations and quotient subgroups	4	Lecture	Participation/ Discussion
IV	Phrase structure grammars	4	Lecture	Participation/ Discussion
	Rewriting rules, derivation sentential forms	5	Lecture	Participation/ Discussion
	Language generated by grammar, regular, context free and context sensitive grammar and languages	6	Lecture	Participation/ Discussion
V	Polynomial expression, telescopic form	5	Lecture	Participation/ Discussion
	Recursion theorem	3	Lecture	Participation/ Discussion
	Closed form expression, generating function	4	Lecture	Participation/ Discussion
	Solution of recurrence relation using generating function	3	Lecture	Participation/ Discussion

Teaching methods:

Lectures: Six per week
Student Seminars: two per week
Assignments: The students will be asked to read the textbook in advance and write articles on given topics
PowerPoint Presentations
Quiz
Group Discussion

Modes Of Assessment	**Minimum Score Required (to Qualify for the next Exam /Class)**	
Continuous Internal Evaluation(CIE) 1.Class Tests(Unit wise)		
	40%	**After Each Unit**
2.Student Seminars		**Every Week**
3.In House Exams	**40%**	**Last week Of March**
End of Semester	**20%**	**Last Week of April**

Reference books:

S.no	**Standard reference books**	**Author**
1	Discrete Mathematical Structure with application to Computer Science	Trambley, J.P. and Manohar, R
2	Elements Of Discrete Mathematics	Liu, C.L.
3	Applied Discrete Structure for Computer Science	Alan Doer

Attendance Policy:

Lecture attendance is mandatory. Students are expected to maintain 75% attendance of the total lectures delivered, failing which they will be detained from appearing in university exams.

CURRICULUM PLANNING AND IMPLEMENTATION

Department: Mathematics
Name of the faculty Member: Prof. Palwinder Singh
Course Name: Statistics II
Class: M.Sc
Semester: IV
Availability Timings: 9.00 AM to 3.00 PM
E-mail: palwindermathlkc@gmail.com

Course Objectives:

Recognize important differences between descriptive and inferential statistics; distinguish between different types of variables and data; summarize, organize, tabulate and graph statistical data; read and understand statistical data present in various forms of the media; find and analyze measures of center and variation for quantitative data.

Program Learning Outcomes:

(Knowledge and understanding, Intellectual skills, practical skills) Learning outcomes:

W. Knowledge and Understanding:

Students will be able to

- Calculate a critical value from a normal, t, chi - square, and f distribution.
- Calculate an appropriate confidence interval for a population parameter for a given data set.
- Perform an appropriate hypothesis tests for a population parameter for a given data set.
- Perform a Chi - Square Test of Independence for a contingency table.
- calculate a linear regression for a given data set

X. Intellectual(cognitive/Analytical) skills:

- Understand, apply and compute in one- and two- sample estimation problems.
- Understand, apply and compute in one- and two- sample tests of hypotheses problems.
- Recognize the relationship between the confidence interval estimation and tests of hypothesis.
- Understand, apply and examine the goodness-of-fit test, test for independence and homogeneity.
- Recognize the basic concepts of simple linear regression and correlation.
- Recognize the concept of the analysis-of-variance technique and the strategy of experimental design.

Y. Practical skills:

- Students will be able to compete successfully for internship and employment positions in government, industry, and non-profit organizations.
- Students will have a predisposition for outreach toward application areas such as physical sciences, financial services, and social sciences and have the knowledge, experience, and motivation to bring the tools of mathematics and statistics to bear on real-world problems.
- Students will have the intellectual curiosity and flexibility to grow with developing technology and new methods mathematics and statistics.

Detailed Course content available at www.gndu.ac.in

Teaching Outline:

Unit	Lecturewise Breakage	No.of Lectures	Mode of Delivery*	Students Role*
I	Chi-Square distribution	4	Lecture	Participation/ Discussion
	t,F distribution	6	Lecture	Participation/ Discussion
	Distribution of sample mean and variance	5	Lecture	Participation/ Discussion
	Distribution of ordered statistics	4	Lecture	Participation/ Discussion
II	Estimators	3	Lecture	Participation/ Discussion
	Properties of Unbiasedness	4	Lecture	Participation/ Discussion

	Consistency, suffiency, Efficiency	5	Lecture	Participation/ Discussion
	Completeness, uniqueness,		Lecture	Participation/ Discussion
	Method of estimation	5	Lecture	Participation/ Discussion
III	Null hypothesis and its test of significance	4	Lecture	Participation/ Discussion
	Simple and Composite hypothesis	2	Lecture	Participation/ Discussion
	M.P test, U.M.P test, Likelihood test	5	Lecture	Participation/ Discussion
IV	Test of mean and variance in the normal distribution	5	Lecture	Participation/ Discussion
	Test of single proportion and equality of two proportions	3	Lecture	Participation/ Discussion
	Chi-Square test, t-test, F-test	6	Lecture	Participation/ Discussion
V	Gauss Markoff Linear Model	4	Lecture	Participation/ Discussion
	BLUE, Gauss Markoff Theorem	6	Lecture	Participation/ Discussion
	Estimation with linear restriction on Parameters	4	Lecture	Participation/ Discussion
	Residual sum of squares analysis of variance, analysis of Variance for one way and two way classified data with one observation per cell	4	Lecture Lecture	Participation/ Discussion Participation/ Discussion

Teaching methods:

- Lectures: Six per week
- Student Seminars: two per week
- Assignments: The students will be asked to read the textbook in advance and write articles on given topics

- PowerPoint Presentations
- Quiz
- Group Discussion

Modes Of Assessment	**Minimum Score Required (to Qualify for the next Exam /Class)**	
Continuous Internal Evaluation(CIE) 1.Class Tests(Unit wise)		
	40%	**After Each Unit**
		Every Week
2.Student Seminars 3.In House Exams	**40%**	**Last week Of March**
End of Semester	**20%**	**Last Week of November April**

Reference books:

S.no	**Standard reference books**	**Author**
1	Intoduction to Mathematical Statistics	Hogg R.V., Mckean, J.W. and Craig A.T
2	Intoduction to Mathematical Statistics	Hoel P.G
3	Fundamentals of Mathematical Statistics	Gupta S.C and Kapoor V.K
4	Mathematical Statistics	Mukhopadhyay.P
5	An Outline of Statistical theory, Vol. I	Goon, A.M.,Gupta M.K, & Dasgupta B.
6	Fundamental of statistic, Vol. I	Goon, A.M.,Gupta M.K, & Dasgupta B.

Attendance Policy:

Lecture attendance is mandatory. Students are expected to maintain 75% attendance of the total lectures delivered, failing which they will be detained from appearing in university exams.

CURRICULUM PLANNING AND IMPLEMENTATION

Department: Mathematics
Name of the faculty Member: Ms. Nitika Chugh
Course Name: Topology II
Class: M.Sc
Semester: IV
Availability Timings: 9.00 AM to 3.00 PM
E-mail: nitika.nitj@gmail.com

Course Objectives:

The aim of the course is to provide for the students an introduction to theory of metric and topological spaces with emphasis on those topics that are important to higher mathematics. The course focuses on the basic notions of metric and topological spaces, properties of continuous mappings selected types of topological spaces (compact and connected spaces) and basic theorems on topological spaces.

Program Learning Outcomes:

(Knowledge and understanding, Intellectual skills, general skills) Learning outcomes:

A. Knowledge and Understanding:

- Mention theories and concepts used in Mathematical Logic and Topology.
- Identify the steps required to carry out a piece of research on a topic within Mathematical Logic and Topology.
- Recognize the contribution and impacts of Mathematical Logic and Topology in real life problem.

B. Intellectual(cognitive/Analytical) skills:

- Apply appropriate theories, principles and concepts relevant to the Topology.
- Formulate a reasoned argument from a variety of sources.

- Analyze and interpret information from a variety of sources relevant to Mathematical Logic and Topology.
- Select a reasoned argument to the solution of familiar and unfamiliar problems relevant to Topology.

C. General skills:

- Think independently, Set tasks and solve problems on ethical scientific basis relevant to Topology.
- Communicate with others positively as part of a group, involving leadership, group dynamics and interpersonal skills such as listening, negotiation and persuasion relevant to Mathematical Logic and Topology.
- Use information and communication technology to discuss problems relevant to Topology.

Detailed Course content available at www.gndu.ac.in

Teaching Outline:

Unit	Lecture wise Breakage	No. of lectures	Mode of Delivery*	Students Role*
I	Higher Separation Axioms: Completely regular space	3	Lecture	Participation/ Discussion
	Tychonoff spaces	4	Lecture	Participation/ Discussion
	Completely normal space	3	Lecture	Participation/ Discussion
	Metric spaces as Hausdorff regular, normal and completely normal space	4	Lecture	Participation/ Discussion
	Product of metric spaces	3	Lecture	Participation/ Discussion
II	Compact spaces	4	Lecture	Participation/ Discussion
	Finite intersection property	2	Lecture	Participation/ Discussion

	Compactness of subsets of real line	3	Lecture	Participation/ Discussion
	Relation of compact spaces with Hausdroff spaces, regular and normal spaces	4	Lecture	Participation/ Discussion
III	Sequentially compact spaces	3	Lecture	Participation/ Discussion
	Bolzano Weierstrass property	3	Lecture	Participation/ Discussion
	Countably ,Locally compact spaces	4	Lecture	Participation/ Discussion
	Compactness in terms of base element and sub- base element Tychonoff theorem, One point compactification	5	Lecture	Participation/ Discussion
IV	The Stone –Cech compactification	4	Lecture	Participation/ Discussion
	Evaluation mappings, Separate point family, Closed set family,	5	Lecture	Participation/ Discussion
	Tychnoff cube, Embedding mapping ,Urysohn Metrization theorem	7	Lecture	Participation/ Discussion
V	Directed sets and nets, Convergence of net in a space, Clustering of a net, nets and continuity	3	Lecture	Participation/ Discussion
	Nets in product spaces, Ultra nets, Compactness in term of nets	4	Lecture	Participation/ Discussion
	Filters and Their convergence	4	Lecture	Participation/ Discussion
	Ultra filters and compactness	6	Lecture	Participation/ Discussion

Teaching methods:

Lectures: Six per week
Student Seminars: two per week
Assignments: The students will be asked to read the textbook in advance and write articles on given topics
PowerPoint Presentations
Quiz
Group Discussion

Modes Of Assessment	**Minimum Score Required (to Qualify for the next Exam /Class)**	
Continuous Internal Evaluation(CIE)		
1.Class Tests(Unit wise)	**40%**	**After Each Unit**
2.Student Seminars		**Every Week**
3.In House Exams	**40%**	**Last week Of March**
End of Semester	**20%**	**Last Week of April**

Reference books:

S.no	**Standard reference books**	**Author**
1	Elementary General Topology(Chapter 2 to 8)	T.O.Moore
2	General Topology (Chapter 1 to 5)	J.L.Kelley
3	Topology	J.R.Munkres
4	Introduction to Topology and Modern Analysis	G.F.Simmons
5	Topology, McGraw Hill 2005	S.W.Davis

Attendance Policy:
Lecture attendance is mandatory. Students are expected to maintain 75% attendance of the total lectures delivered, failing which they will be detained from appearing in university exams.

DEPARTMENT OF MATHEMATICS

CURRICULUM PLANNING AND IMPLEMENTATION

Even Semester (2019-20)

(P.G. Classes)

CURRICULUM PLANNING AND IMPLEMENTATION

Department: Mathematics
Name of the faculty Member: Prof. Ajay Kumar & Dr. Dinkar Sharma
Class: B.Sc(Non Medical/Computer Science/Economics)/B.A
Course: Calculus II
Semester: II
Availability Timings: 9.00 AM to 3.00 PM
E-mail: ajaykaushal1993@gmail.com, dinkar.nitj@gmail.com

Course Objectives:

This course introduces the student to integral calculus with the techniques of integration and application of integration to physical problem.

Program Learning Outcomes:

(Knowledge and understanding, Intellectual skills, practical skills)
Learning outcomes:

D. Knowledge and Understanding:

- Extend the concept of integrals to a variety of applications, establishing several integration
- Use a variety of mathematical techniques to evaluate integrals
- Develop problem solving skills through diverse applications of the integral
- Analyze the parameterization of curves and the polar coordinate system

E. Intellectual(cognitive/Analytical) skills:

- Examine various techniques of integration and apply them to definite and improper integrals,
- Approximate definite integrals using numerical integration techniques and solve related problems,
- Model physical phenomena using partial differential equations,-
- Compute limits of, differentiate, integrate and solve related problems involving functions represented parametrically or in polar coordinates,
- Differentiate, and integrate functions represented using power series expansions, including Taylor series, and solve related problems.

F. Practical skills:

Students will be able to:

- Evaluate iterated integrals and switch the order of integration.
- Find volumes of solids by calculating appropriate double integrals in rectangular and polar coordinates.
- Find surface area using a double integral.
- Evaluate triple integrals and use them to find volumes in rectangular, cylindrical and spherical coordinates.
- Use a Jacobian to make a change of variables in a double integral.

Teaching Outline:

Section	Lecture wise Breakage	No. of Lectures	Mode of Delivery*	Students Role*
A	Limit and Continuity of functions	7	Lecture	Participation/ Discussion
	Partial Differentiation	12	Lecture	Participation/ Discussion
B	Euler's theorem on Homogeneous functions, Taylor's theorem	5	Lecture	Participation/ Discussion
	Jacobians	5	Lecture	Participation/ Discussion
	Envelopes and Evolutes	6	Lecture	Participation/ Discussion
	Maxima , Minima and Saddle points of functions of two variables	6	Lecture	Participation/ Discussion
C	Lagrange's undetermined multiplier method	4	Lecture	Participation/ Discussion
	Double and Triple Integrals	5	Lecture	Participation/ Discussion
	Applications to evaluation of areas, volumes, Surfaces of Solid of revolution	9	Lecture	Participation/ Discussion

	Change of order of integration in double integrals	3	Lecture	Participation/ Discussion
D	Application to evaluation of area, volume, surface of solids of revolutions	8	Lecture	Participation/ Discussion

Teaching methods:

- Lectures: Six per week
- Student Seminars: two per week
- Assignments: The students will be asked to read the textbook in advance and write articles on given topics
- PowerPoint Presentations
- Quiz
- Group Discussion

Modes Of Assessment	**Minimum Score Required (to Qualify for the next Exam /Class)**	
Continuous Internal Evaluation(CIE)		
1.Class Tests(Unit wise)	**40%**	**After Each Unit**
2.Student Seminars		**Every Week**
3.In House Exams	**40%**	**Last week Of March**
End of Semester	**20%**	**Last Week of April**

Reference books:

S.no	**Standard reference books**	**Author**
1	Integral Calculus, Sultan Chand &sons	Narayan, S
2	Advanced Engineering Mathematics	Kreyszig, E
3	Differential calculus, Sultan Chand &sons	Narayan, S

Attendance Policy:

Lecture attendance is mandatory. Students are expected to maintain 75% attendance of the total lectures delivered, failing which they will be detained from appearing in university exams.

Name of the faculty Member: Prof. Priyanka Sharma
Class: B.Sc (Non Medical/Computer Science/Economics)/B.A
Course: Calculus and Differential equations II
Semester: II
Availability Timings: 9.00 AM to 3.00 PM
E-mail: priyanka706.ps@gmail.com

Course Objectives:

This course provides an introduction to topics involving calculus and ordinary differential equations. Both Calculus and Differential equations have applications in all areas of applied Sciences and engineering. Upon completion, students will be able to understand the applications of differential and integral calculus and also demonstrate understanding of the theoretical concepts and select and use appropriate techniques for finding solutions to differential equations.

Program Learning Outcomes:

(Knowledge and understanding, Intellectual skills, practical skills,) Learning outcomes:

A. Knowledge and Understanding:

-Write the definition of indefinite and definite integrals.
-Define the integral of the inverse trigonometric and hyperbolic functions.
-State the Fundamental theorem of calculus
-Find general solutions to first order, second order and higher order homogeneous and non-homogenous differential equations with constant and variable coefficients.
-find the series solution of differential equation

B. Intellectual(cognitive/Analytical) skills:

-Evaluate Indefinite integral involving hyperbolic functions and Definite integral of all the functions.
-Sketch the graph of curves (Cartesian and parametric co-ordinates)
-Calculate areas of plane regions and arc length.
- Select and apply appropriate methods to solve differential equations.
-Apply power series method to find solution of Differential equations involving Bessel and Legendre equations.
- Use fundamental theorem of calculus to evaluate integral involving algebraic and transcendental functions.

C. Practical skills:

-Present mathematics to others, both in oral and written form clearly and in a well organized manner.

- Have the ability to carry out complex calculations orally and mentally.

Teaching Outline:

Section	Lecture wise Breakage	No. of Lectures	Mode of Delivery*	Students Role*
A	Asymptotes	4	Lecture	Participation/ Discussion
	Concavity and Convexity, Point of Inflexion.	4	Lecture	Participation/ Discussion
	Multiple Points	2	Lecture	Participation/ Discussion
	Curve Tracing	3	Lecture	Participation/ Discussion
	Curvature	4	Lecture	Participation/ Discussion
B	Integration of Hyperbolic Functions	2	Lecture	Participation/ Discussion
	Reduction Formulae	8	Lecture	Participation/ Discussion
	Definite Integrals	5	Lecture	Participation/ Discussion
	Fundamental theorem of integral calculus.	3	Lecture	Participation/ Discussion
	Quadrature	4	Lecture	Participation/ Discussion
	Rectification	3	Lecture	Participation/ Discussion
C	Exact Differential Equations	4	Lecture	Participation/ Discussion
	Equations of First Order and Higher Degree	5	Lecture	Participation/ Discussion

	Clairaut's form, Singular solutions	4	Lecture	Participation/ Discussion
	Orthogonal Trajectories	2	Lecture	Participation/ Discussion
D	Linear differential Equations with Constant Coefficients, Variation of Parameters Methods, Reduction Methods	7	Lecture	Participation/ Discussion
	Linear Equation with Variable Coefficients	2	Lecture	Participation/ Discussion
	Series solutions of Differential Equations. Power Series Method, Bessel and Legendre Equations.	4	Lecture	Participation/ Discussion

Teaching methods:

Lectures: Six per week
Student Seminars: two per week
Assignments: The students will be asked to read the textbook in advance and write articles on given topics
PowerPoint Presentations
Quiz
Group Discussion

Modes Of Assessment	**Minimum Score Required (to Qualify for the next Exam /Class)**	
Continuous Internal Evaluation(CIE)		
1.Class Tests(Unit wise)	**40%**	**After Each Unit**
2.Student Seminars		**Every Week**
	40%	**Last week Of March**

3.In House Exams		
End of Semester	**20%**	**Last Week of April**

Reference books:

S.no	Standard reference books	Author
1	Introductory Course in Differential Equations. Orient London Longman (India) 1967	D.A.Murray
2	Differential Equations, Tata McGraw Hill,1972	G.F.Simmons
3	Integral Calculus, Pothishala Pvt. Ltd., Allahabad	Gorakh Prasad
4	An Introduction to Ordinary Differential Equations, Prentice Hall of India, 1961	E.A.Codington
5	Advanced Engineering Mathematics, John Wiley and Sons, 1999	Erwin Kreyszig

Attendance Policy:

Lecture attendance is mandatory. Students are expected to maintain 75% attendance of the total lectures delivered, failing which they will be detained from appearing in university exams.

Name of the faculty Member: Prof. Nitika Chugh
Class: B.Sc(Non Medical/Computer Science/Economics)/B.A
Course: Solid Geometry
Semester: IV
Availability Timings: 9.00 AM to 3.00 PM
E-mail: nitika.lkc@gmail.com

Course Objectives:

This course provides an introduction of solid geometry that studies the size, shape, and position of 2-dimensional shapes and 3-dimensional figures.
Students will be able to identify geometric shapes in objects they use in their daily lives. Studying solid geometry provides many foundational skills and helps to build the thinking skills of logic, deductive reasoning, analytical reasoning, and problem-solving.

Program Learning Outcomes:

(Knowledge and understanding, Intellectual skills, practical skills, transferable skills)
Learning outcomes:

G. Knowledge and Understanding:

- The method of using virtual reality in desktop application that is intended to be used for solid geometry
- Geometry covers a whole range of concepts which will be encountered in everyday life
- Show them examples of 2-D and 3-D shapes, such as a circle and a sphere
- Geometry has many practical applications like architects and interior designers need to use their geometry knowledge to guide their designs

H. Intellectual(cognitive/Analytical) skills:

- Allowing the systematic use of linear equations and matrix algebra, which are important for higher dimensions
-

I. Practical skills:

- 3-D Computer graphics revolutionized animation, Video games, graphics etc.
- Architectural designing is another area in which applications of solid geometry play a major role

Teaching Outline:

Section	Lecture wise Breakage	No. of Lectures	Mode of Delivery*	Students Role*
A	Cylinder and its properties	**7**	Lecture	Participation Discussion
	Different kind of Cylinder	**3**	Lecture	Participation Discussion
	Right circular, elliptic, hyperbolic and parabolic in straight form	**8**	Lecture	Participation Discussion
	Cone with vertex at origin	**3**	Lecture	Participation Discussion
	Cone as a surface generated by a line passing through a fixed curve	**8**	Lecture	Participation Discussion
	Right circular and elliptic cone	**5**	Lecture	Participation Discussion
B	Equation of a surface of a revolution	**5**	Lecture	Participation Discussion
	Equation of a ellipsoid	**4**	Lecture	Participation Discussion
	Equation of a hyperboloid	**4**	Lecture	Participation Discussion
	Equation of a paraboloid	**4**	Lecture	Participation Discussion
	Surface represented by general equation of second degree	**10**	Lecture	Participation Discussion
	Tanget line, Tanget	**8**	Lecture	Participation

	plane and Normal planes			Discussion

What will be the teaching methods:

Lectures: Six per week
Student Seminars: two per week
Assignments: The students will be asked to read the textbook in advance and write articles on given topics
PowerPoint Presentations
Quiz
Group Discussion

Modes Of Assessment	**Minimum Score Required (to Qualify for the next Exam /Class)**	
Continuous Internal Evaluation(CIE)		
1.Class Tests(Unit wise)	**40%**	**After Each Unit**
2.Student Seminars		**Every Week**
3.In House Exams	**40%**	**Last week Of March**
End of Semester Exam	**20%**	**Last Week of April**

Reference books:

S.no	**Standard reference books**	**Author**
1	Analytical Solid Geometry	S. Narayan

2	Advanced Engineering Mathematics	E. Kreyszig

Attendance Policy:
Lecture attendance is mandatory. Students are expected to maintain 75% attendance of the total lectures delivered, failing which they will be detained from appearing in university exams.

Name of the faculty Member: Prof. Ajay Kumar
Class: B.Sc (Non Medical/Computer Science/Economics)/B.A
Course: Statics and Vector Calculus
Semester: IV
Availability Timings: 9.00 AM to 3.00 PM
E-mail: ajaykaushal1993@gmail.com

Course Objectives:

This Course introduces the student to review vector arithmetic, distinguish point and vectors, relate geometric concepts to their algebraic representation, describe point, line, and planes, use the dot product and cross product and their applications in Graphics. In Statics, we deal with equilibrium of bodies under action of forces (bodies may be either at rest or move with a constant velocity)

Program Learning Outcomes:

(Knowledge and understanding, Intellectual skills, practical skills, transferable skills)
Learning outcomes:

J. Knowledge and Understanding:

Students will be able to:

- Identify conservative vector fields.
- Find the divergence and curl of a vector field.
- Evaluate line integrals of curves and vector fields.
- Use Green's theorem to evaluate line integrals.
- Gradient vector fields and constructing potentials

K. Intellectual(cognitive/Analytical) skills:

On completion of this module, students should be able to:

a) calculate vector and scalar derivatives of vector and scalar fields using the grad, div and curl operators in Cartesian and in cylindrical and spherical polar coordinates;
b) use suffix notation to manipulate Cartesian vectors and their derivatives;
c) calculate multiple integrals in two and three dimensions including changing variables using Jacobians;
d) calculate line and surface integrals and use the various integral theorems.

Undertake the analysis of symmetric beams under vertical loads and torsion of cylindrical shafts
2. Evaluate plane stresses

L. **Practical skills:**

- The integral ideas of the functions defined including line, surface and volume integrals - both derivation and calculation in rectangular, cylindrical and spherical coordinate systems and understand the proofs of each instance of the fundamental theorem of calculus.
- Examples of the fundamental theorem of calculus and see their relation to the fundamental theorems of calculus in calculus leading to the more generalised version of Stokes' theorem in the setting of differential forms.
- The differential ideas of divergence, curl, and the Laplacian along with their physical interpretations, using differential forms or tensors to represent derivative operations.

Detailed Course content available at www.gndu.ac.in

Teaching Outline:

Section	Lecturewise Breakage	No. of Lectures	Mode of Delivery*	Students Role*
A	Forces acting at a point	3	Lecture	Participation/ Discussion
	Any number of forces acting at a point	5	Lecture	Participation/ Discussion
	Parallel Forces	4	Lecture	Participation/ Discussion
	Moments	6	Lecture	Participation/ Discussion
	Couples	5	Lecture	Participation/ Discussion
	Equilibrium of three Coplanar forces acting on a rigid body	5	Lecture	Participation/ Discussion
	Equilibrium of a rigid body under the action	6	Lecture	Participation/ Discussion

	Friction	8	Lecture	Participation/ Discussion
	Centre of Gravity	8	Lecture	Participation/ Discussion
B	Differentiation of Vectors	7	Lecture	Participation/ Discussion
	Gradient, Divergence and Curl	6	Lecture	Participation/ Discussion
	Vector Integration	7	Lecture	Participation/ Discussion
	Gauss, Green and Stoke's Theorems	7	Lecture	Participation/ Discussion

What will be the teaching methods?

Lectures: Six per week
Student Seminars: two per week
Assignments: The students will be asked to read the textbook in advance and write articles on given topics
PowerPoint Presentations
Quiz
Group Discussion

Modes Of Assessment	**Minimum Score Required (to Qualify for the next Exam /Class)**	
Continuous Internal Evaluation(CIE)		
1.Class Tests(Unit wise)	**40%**	**After Each Unit**
2.Student Seminars		**Every Week**
3.In House Exams	**40%**	**Last week Of March**
End of Semester	**20%**	**Last Week of April**

Reference books:

S.no	Standard reference books	Author
1	Statics, Macmillan and Company, London.	S.L. Loney
2	A text Book on Statics, Optical Pvt. Ltd., Allahabad.	R.S. Verma
3	Introduction to Vector Calculus and Tensor	Spiegal,M.R.
4	Vector Analysis	Spiegal.M.R.

Attendance Policy:

Lecture attendance is mandatory. Students are expected to maintain 75% attendance of the total lectures delivered, failing which they will be detained from appearing in university exams.

Name of the faculty Member: Prof. Palwinder Singh
Class: B.Sc(Non Medical/Computer Science/Economics)/B.A
Course: Numerical Analysis
Semester: VIth
Availability Timings: 9.00 AM to 3.00 PM
E-mail: bolinapalwinder@gmail.com

Course Objectives:

This course aims to provide a first approach to the subject of algebra, which is one of the basic pillars of modern mathematics. The focus of the course will be the study of certain structures called groups, rings, fields and some related structures. Abstract algebra gives to student a good mathematical maturity and enables to build mathematical thinking and skill.

Program Learning Outcomes:

(Knowledge and understanding, Intellectual skills, transferable skills) Learning outcomes:

M. Knowledge and Understanding:

Students will know how

- Solve an algebraic or transcendental equation using an appropriate numerical method.
- Approximate a function using an appropriate numerical method.
- solve a differential equation using an appropriate numerical method
- evaluate a derivative at a value using an appropriate numerical method
- code a numerical method in a modern computer language

N. Intellectual(cognitive/Analytical) skills:

- Derive numerical methods for approximating the solution of problems of continuous mathematics,
- Analyze the error incumbent in any such numerical approximation,
- Implement a variety of numerical algorithms using appropriate technology.
- Compare the viability of different approaches to the numerical solution of problems arising in roots of solution of non-linear equations, interpolation.
- And approximation, numerical differentiation and integration, solution of linear systems.

O. Transferable skills:

- solve a linear system of equations using an appropriate numerical method
- Problem solving and Analytical skills
- Be able to develop numerical literacy
- Social responsibility and global citizenship skills

Detailed Course content available at www.gndu.ac.in

Teaching Outline:

Section	Lecture wise Breakage	No. of Lectures	Mode of Delivery*	Students Role*
A	Error Generation and Error Estimation	8	Lecture	Participation/ Discussion
	Solution of Non-Linear equations	8	Lecture	Participation/ Discussion
	Solution of Linear Equations	9	Lecture	Participation/ Discussion
	Forward, Backward, Central, Divided Differences and Shift operators	10	Lecture	Participation/ Discussion
B	Finite difference interpolation with equal intervals and unequally spaced points	8	Lecture	Participation/ Discussion
	Numerical Integration	9	Lecture	Participation/ Discussion
	Numerical Differentiation	8	Lecture	Participation/ Discussion
	Numerical Solution of Ordinary Differential Equations	10	Lecture	Participation Discussion

Teaching methods:

Lectures: Six per week
Student Seminars: two per week
Assignments: The students will be asked to read the textbook in advance and write articles on given topics
PowerPoint Presentations
Quiz
Group Discussion

Modes Of Assessment	**Minimum Score Required (to Qualify for the next Exam /Class)**	
Continuous Internal Evaluation(CIE)		
1.Class Tests(Unit wise)	**40%**	**After Each Unit**
2.Student Seminars		**Every Week**
3.In House Exams	**40%**	**Last week Of March**
End of Semester	**20%**	**Last Week of April**

Reference books:

S.no	**Standard reference books**	**Author**
1	Introductory Methods of Numerical Analysis, 2003 (3rd Edition), prentice Hall of India	S.S. Sastry
2	Introduction to Numerical Analysis	A.Maritava Gupta and Subash Ch. Bose

Attendance Policy:

Lecture attendance is mandatory. Students are expected to maintain 75% attendance of the total lectures delivered, failing which they will be detained from appearing in university exams.

Name of the faculty Member: Prof. Priyanka Sharma
Class: B.Sc (Non Medical/Computer Science/Economics)/B.A
Course: Linear Algebra
Semester: VI
Availability Timings: 9.00 AM to 3.00 PM
E-mail: priyanka706.ps@gmail.com

Course Objectives:

Algebraic structures -- such as groups, rings, and fields -- are pervasive in mathematics. This course focuses on (commutative) rings, which are sets equipped with two (commutative) operations (called addition and multiplication), and that contain an additive identity and an additive inverse for each element of the set. A fundamental example of a ring is **Z**, the set of integers; other important examples include **Q**, **Z** modulo n, and **Q**[X], which is the set of polynomials in X with rational Coefficients.

Program Learning Outcomes:

(Knowledge and understanding, Intellectual skills, practical skills) Learning outcomes:

P. Knowledge and Understanding:
Students will be able to

- Develop an understanding of linear algebra in mathematics, natural and social sciences.
- Use matrix algebra to analyze and solve equations arising in many applications that require a background in linear algebra.
- Utilize vector space terminology and describe how closely other vector spaces resemble R^n.

Q. Intellectual(cognitive/Analytical) skills:

- Demonstrate factual knowledge of the fundamental concepts of spanning, linear independence, and linear transformations.
- Acquire communication and organizational skills, including effective written communication in their weekly assignments.

- Use visualization, spatial reasoning as well as geometric properties and strategies to mode, solve problems and view solutions especially in R^2 and R^3.

R. <u>General skills:</u>

- Apply mathematical methods involving arithmetic, algebra, geometry and graphs to solve problems.
- Represent mathematical information and communicate mathematical reasoning symbolically and verbally.
- Interpret and analyze numerical data, mathematical concepts and identify patterns to formulate and validate reasoning.

<u>Teaching Outline</u>:

Section	**Lecture wise Breakage**	**No. of Lectures**	**Mode of Delivery***	**Students Role***
A	Group	6	Lecture	Participation/ Discussion
	Ring	6	Lecture	Participation/ Discussion
	Field	4	Lecture	Participation/ Discussion
	Vector Space	7	Lecture	Participation/ Discussion
	Subspace	5	Lecture	Participation/ Discussion
	Linear Span, Linear Dependence, Linear Independence of Vectors.	6	Lecture	Participation/ Discussion
	Basis of vector space, finitely generated vector space, Existence theorem for Basis, Invariance of number of elements of basis set. Dimension of sum of two subspaces.	9	Lecture	Participation/ Discussion

	Quotient Space and its Dimensions.	4	Lecture	Participation/ Discussion
B	Linear Transformation, Algebra of Linear Transformation.	6	Lecture	Participation/ Discussion
	Rank Nullity Theorem	4	Lecture	Participation/ Discussion
	Isomorphism and Isomorphic spaces	4	Lecture	Participation/ Discussion
	Matrix of a Linear Transformation, Changes of basis, Linear Operator.	7	Lecture	Participation/ Discussion

Teaching methods:

- Lectures: Six per week
- Student Seminars: two per week
- Assignments: The students will be asked to read the textbook in advance and write articles on given topics
- PowerPoint Presentations
- Quiz
- Group Discussion

Modes Of Assessment	**Minimum Score Required (to Qualify for the next Exam /Class)**	
Continuous Internal Evaluation(CIE)		
1.Class Tests(Unit wise)	**40%**	**After Each Unit**
		Every Week
2.Student Seminars	**40%**	**Last week Of March**
3.In House Exams		
End of Semester	**20%**	**Last Week of April**

Reference books:

S.no	Standard reference books	Author
1	Linear Algebra, 2nd Edition, Prentice Hall, New Jersey, 1971	Herstein, I.N.
2	An introduction to Linear algebra, East West Press,1976	V.Krishnamurthy, V.P.Mainra and J.L.Arora
3	Linear Algebra,1997	Surjit Singh
4	A text book of Matrices, 10th Edition(2002), S. chand & Co.	Shanti Narayan & P.K. Mittal

Attendance Policy:

Lecture attendance is mandatory. Students are expected to maintain 75% attendance of the total lectures delivered, failing which they will be detained from appearing in university exams.

Name of the faculty Member: Prof. Ajay Kumar
Class: B.Sc(Bio-Technology)
Course: Biostatistics
Semester: II
Availability Timings: 9.00 AM to 3.00 PM
E-mail: ajaykaushal1993@gmail.com

Course Objectives:

Biostatistics provides rigorous training in statistical theory and methodologies that are suitable for applications in research, collaboration and consulting on a broad spectrum of health and life science problems. The main purpose of the course is to enable the students to describe and explain the data in with best descriptive statistics measurements and how calculate probability of different events in addition to some important measurements related to clinical studies and industry.

Program Learning Outcomes:

(Knowledge and understanding, Intellectual skills, practical skills, transferable skills)
Learning outcomes:

A. **Knowledge and Understanding:**
Student will be able to
-Learn statistical methods to analyze summarize and present data.
-Demonstrate an understanding of the central concepts of modern statistical theory and their probabilistic foundation.
-Communicate the results of statistical analysis accurately.
-Read and learn new statistical procedures independently.
-Understand basics of probability, probability rules and conditional probability rules.
-Recognize the basic concepts of simple linear regression and correlation.
-Understand basic statistical theory to design the experiments.
-Aware the assumptions of various statistical methods before experimental design and data analysis.
-Understand the fundamental and principles of Biostatistics.

B. **Intellectual(cognitive/Analytical) skills:**

-Apply basic concepts of probability, probability laws in solving biological problems in the field of life sciences.
-Apply concepts and methods from biostatistics and epidemiology disciplines jointly.
- Apply and examine the goodness-of-fit test, test for independence and homogeneity.
-Differentiate between methods of data presentation.
-Differentiate between alternative and null hypothesis.
-calculate measures of central tendency and measures of dispersion.

C. **Practical skills:**

-Communicate effectively with biostatistician and non- biostatisticians collaborators
-Organize results in appropriate visual displays or tables.
-Have fun by crunching number and master a highly useful skill for the career.
-Use results of applied statistics to make informed decisions.
-Give examples of different types of data arising in clinical studies.

Teaching Outline:

Section	Lecture wise Breakage	Number of Lectures	Mode of Delivery*	Students Role*
Unit I	Mean	6	Lecture	Participation/ Discussion
	Median	5	Lecture	Participation/ Discussion
	Mode	4	Lecture	Participation/ Discussion
	Standard deviation	6	Lecture	Participation/ Discussion
	Variance	2	Lecture	Participation/ Discussion
	Covariance	2	Lecture	Participation/ Discussion
Unit II	Probability	5	Lecture	Participation/ Discussion
	Conditional Probability,	6	Lecture	Participation/ Discussion

	Independent events			
	Bayes Theorem	5	Lecture	Participation/ Discussion
Unit III	Scatter diagram	2	Lecture	Participation/ Discussion
	Linear Correlation	6	Lecture	Participation/ Discussion
	Linear Regression	6	Lecture	Participation/ Discussion
Unit IV	Concept of Null and Alternate Hypothesis	9	Lecture	Participation/ Discussion
	Chi-square test	6	Lecture	Participation/ Discussion

What will be the teaching methods:

Lectures: Six per week
Student Seminars: one per week
Assignments: The students will be asked to read the textbook in advance and write articles on given topics
PowerPoint Presentations
Quiz
Group Discussion

Modes Of Assessment	**Minimum Score Required (to Qualify for the next Exam /Class)**	
Continuous Internal Evaluation(CIE)		
1.Class Tests(Unit wise)	**40%**	**After Each Unit**
2.Student Seminars		**Every Week**
3.In House Exams	**40%**	**Last week Of April**
End of Semester Exam	**20%**	**Last Week of May Onwards**

Reference books:

S.no	Standard reference books	Author
1	Fundamentals of Statistics,Kitab Mahal, Allahabad (1984)	D.N. Elhance
2	Statistics for engineering and sciences(IVth edition) Prentice Hall (1995)	W. Mendenhall and T. Sincich
3	Statistical Methods, Sultan Chand and Company, New Delhi (2000)	S.P. Gupta
4	Fundamentals of Mathematical Statistics, Sultan Chand and Company, New Delhi (2000)	V.K. Kapoor and S.C. Gupta
5	Advanced level Statistics, 4^{th} Edition, Melson Thornes (2002)	J. Crawshaw and J Chamber

Attendance Policy:

Lecture attendance is mandatory. Students are expected to maintain 75% attendance of the total lectures delivered, failing which they will be detained from appearing in university exams.

Name of the faculty Member: Prof. Priyanka Sharma
Class: Bachelor of Physiotherapy (Part III)
Course: Research Methodology and Biostatistics
Availability Timings: 9.00 AM to 3.00 PM
E-mail: priyanka706.ps@gmail.com

Course Objectives:

Biostatistics provides rigorous training in statistical theory and methodologies that are suitable for applications in research, collaboration and consulting on a broad spectrum of health and life science problems. This course aims to develop working knowledge of how knowledge is collected, presented and disseminated. It develops the ability to formulate a question, find the data relevant to your question, analyze the data and present your finding skills that benefit professional and personal life.

Program Learning Outcomes:

(Knowledge and understanding, Intellectual skills, practical skills, transferable skills)
Learning outcomes:

S. Knowledge and Understanding:

- Help to learn ethical, political and pragmatic issues involved in the research process.
- Learn to collect, analyze and interpret research data.
- Help to know the types of descriptive statistics typically reported in educational research.
- Understand the fundamental and principles of Biostatistics.
- Recognize the basic concepts of simple linear regression and correlation.
- Understand the fundamental and principles of biostatistics.

T. Intellectual(cognitive/Analytical) skills:

- Enable the students to describe the ethical issues in educational research, including those issues that arise in using qualitative and quantitative research.
- Able to distinguish between a population and a sample

- Able to identify the overall process of designing a research study from its inception to its report.
- Calculate measures of central tendency and measures of dispersion.
- Differentiate between the methods of data presentation.
- Differentiate between alternative and null hypothesis.

U. Practical skills:

- Gain a practical understanding of the various methodological tools used for social scientific research.
- Communicate effectively with biostatistician and non- biostatisticians collaborators.
- Organize results in appropriate visual displays or tables.

Teaching Outline:

Section	Lecture wise Breakage	Teaching Dates	Mode of Delivery*	Students Role*
A	Importance of research in clinical practice, scientific approach, characteristics, purposes and limitations	10	Lecture	Participation/ Discussion
	Ethical issues in research, Elements of informed consent.	12	Lecture	Participation/ Discussion
	Structure of a research proposal	6	Lecture	Participation/ Discussion
B	Research Question including literature review	11	Lecture	Participation/ Discussion
	Principles of measurement, reliability and validity	8	Lecture	Participation/ Discussion
	Experimental Sampling and Design	9	Lecture	Participation/ Discussion

	Descriptive research	5	Lecture	Participation/ Discussion
C	Descriptive Statistics	12	Lecture	Participation/ Discussion
	Comparison of means, T-tests	8	Lecture	Participation/ Discussion
	Analysis of Variance	6		
	Qualitative and quantitative Observations, Measures of central tendency- Arithmetic Mean, Median, Mode, Position of averages, Graphical Representation of data	25	Lecture	Participation/ Discussion
	Measures of Dispersion	8	Lecture	Participation/ Discussion
	Frequency Distribution	3	Lecture	Participation/ Discussion
	Correlations	7	Lecture	Participation/ Discussion

What will be the teaching methods :

Lectures: Six per week
Student Seminars: two per week
Assignments: The students will be asked to read the textbook in advance and write articles on given topics
PowerPoint Presentations
Quiz
Group Discussion

Modes Of Assessment	**Minimum Score Required (to Qualify for the next Exam /Class)**	
Continuous Internal Evaluation(CIE)		

1.Class Tests(Unit wise) 2.Student Seminars 3.In House Exams	**40%**	**After Each Unit**
		Every Week
	40%	**Last week Of March**
End of Annual Exam	**20%**	**Last week Of April**

Reference books:

S.no	Standard reference books	Author
1	Methods in Biostatistics	J.P
2	Statistics in Medicine	Little Brown, Boston
3	Research for Physiotherapist: Project Design and Analysis	Hicks-Churchill Livingstone
4	Biostatistics: The manual for Statistical methods for use in health and nutrition	K.V.Rao- J.P
5	Research methods in Behavioural Sciences	Mohsin-Orient publication

Attendance Policy:

Lecture attendance is mandatory. Students are expected to maintain 75% attendance of the total lectures delivered, failing which they will be detained from appearing in university exams.