NOIDA INTERNATIONAL UNIVERSITY

GREATER NOIDA

School of Sciences

Department of Mathematics

COURSE SYLLABUS

as per CBCS

B.Sc. (Mathematics Hons.)

(ALL SEMESTERS)

w.e.f., 2019-2020

Preamble

Ministry of Human Resource Development (HRD), Govt. of India, has already initiated the process for developing New Education Policy (NEP) in our country to bring out reforms in Indian education system. University Grants Commission (UGC) participates more actively in developing National Education Policy, its execution and promotion of higher education in our country. The UGC has already initiated several steps to bring equity, efficiency and academic excellence in National Higher Education System. The important ones include innovation and improvement in course- curricula, introduction of paradigm shift in learning and teaching pedagogy, examination and education system. The education plays enormously significant role in building of a nation. There are quite a large number of educational institutions, engaged in imparting education in our country. Majority of them have entered recently into semester system to match with international educational pattern. However, our present education system produces young minds lacking knowledge, confidence, values and skills. It could be because of complete lack of relationship between education, employment and skill development in conventional education system. The present alarming situation necessitates transformation and/or redesigning of education system, not only by introducing innovations but developing "learner-centric approach in the entire education delivery mechanism and globally followed evaluation system as well. Majority of Indian higher education institutions have been following marks or percentage based evaluation system, which obstructs the flexibility for the students to study the subjects/courses of their choice and their mobility to different institutions. There is need to allow the flexibility in education system, so that

students depending upon their interests and aims can choose interdisciplinary, intra-disciplinary and skill-based courses. This can only be possible when choice based credit system (CBCS), an internationally acknowledged system, is adopted. The choice based credit system not only offers opportunities and avenues to learn core subjects but also exploring additional avenues of learning beyond the core subjects for holistic development of an individual. The CBCS will undoubtedly facilitate us bench mark our courses with best international academic practices. The CBCS has more advantages than disadvantages. Advantages of the choice based credit system: Shift in focus from the teacher-centric to student-centric education. Student may undertake as many credits as they can cope with (without repeating all courses in a given semester if they fail in one/more courses). CBCS allows students to choose inter-disciplinary, intra-disciplinary courses, skill oriented papers (even from other disciplines according to their learning needs, interests and aptitude) and more flexibility for students). 3 CBCS makes education broad-based and at par with global standards. One can take credits by combining unique combinations. For example, Physics with Economics, Microbiology with Chemistry or Environment Science etc. CBCS offers flexibility for students to study at different times and at different institutions to complete one course (ease mobility of students). Credits earned at one institution can be transferred. Disadvantages: Difficult to estimate the exact marks Workload of teachers may fluctuate Demand good infrastructure for dissemination of education.

CHOICE BASED CREDIT SYSTEM (CBCS)

The CBCS provides an opportunity for the students to choose courses from the prescribed courses comprising core, elective/minor or skill based courses. The courses can be evaluated following the grading system, which is considered to be better than the conventional marks system. Therefore, it is necessary to introduce uniform grading system in the entire higher education in India. This will benefit the students to move across institutions within India to begin with and across countries. The uniform grading system will also enable potential employers in assessing the performance of the candidates. In order to bring uniformity in evaluation system and computation of the Cumulative Grade Point Average (CGPA) based on student's performance in examinations, the UGC has formulated the guidelines to be followed.

Outline of Choice Based Credit System:

1. Core Course:

A course, which should compulsorily be studied by a candidate as a core requirement is termed as a Core course.

2. Elective Course:

Generally a course which can be chosen from a pool of courses and which may be very specific or specialized or advanced or supportive to the discipline/ subject of study or which provides an extended scope or which enables an exposure to some other discipline/subject/domain or nurtures the candidate's proficiency/skill is called an Elective Course.

2.1 Discipline Specific Elective (DSE) Course:

Elective courses may be offered by the main discipline/subject of study is referred to as Discipline Specific Elective. The University/Institute may also offer discipline related Elective courses of interdisciplinary nature (to be offered by main discipline/subject of study).

2.2 Dissertation/Project:

An elective course designed to acquire special/advanced knowledge, such as supplement study/support study to a project work, and a candidate studies such a course on his own with an advisory support by a teacher/faculty member is called dissertation/project.

2.3 Generic Elective (GE) Course:

An elective course chosen generally from an unrelated discipline/subject, with an intention to seek exposure is called a Generic Elective. P.S.: A core course offered in a discipline/subject may be treated as an elective by other discipline/subject and vice versa and such electives may also be referred to as Generic Elective.

3. Ability Enhancement Courses (AEC):

The Ability Enhancement (AE) Courses may be of two kinds: Ability Enhancement Compulsory Courses (AECC) and Skill Enhancement Courses (SEC). "AECC" courses are the courses based upon the content that leads to Knowledge enhancement;

i. Environmental Science and

ii. English/MIL Communication.

These are mandatory for all disciplines. SEC courses are value-based and/or skill-based and are aimed at providing hands-on-training, competencies, skills, etc.

3.1 Ability Enhancement Compulsory Courses (AECC): Environmental Science, English Communication/MIL Communication.

3.2 Skill Enhancement Courses (SEC): These courses may be chosen from a pool of courses designed to provide value-based and/or skill-based knowledge.

Introducing Research Component in Under-Graduate Courses

Project work/Dissertation is considered as a special course involving application of knowledge in solving / analyzing /exploring a real life situation / difficult problem. A Project/Dissertation work would be of 6 credits. A Project/Dissertation work may be given in lieu of a discipline specific elective paper.

Details of courses under B.Sc.(Hons.) Mathematics

Course	*Credits	
	Theory + Practical	**Theory+ Tutorial**
I. Core Course (14Papers)	14×4=56	14×5=70
Core Course Practical/Tutorial*(14Papers)	14×2=28	14×1=14
II. Elective Course(8Papers)		
A.1.DisciplineSpecific Elective **(4Papers)**	4×4=16	4×5=20
A.2.DisciplineSpecificElectiveP ractical/Tutorial* **(4Papers)**	4×2=8	4×1=4
B.1.GenericElective/I nterdisciplinary **(4Papers)**	4×4=16	4×5=20
B.2.GenericElective Practical/Tutorial* **(4Papers)**	4×2=8	4×1=4

- Optional Dissertation or project working place of one Discipline Specific Elective Paper(6 credits) in 6thSemester

III. Ability Enhancement Courses

1. Ability Enhancement Compulsory Courses(AECC)		
(2Papersof 2credit each)	2×2 =4	2×2=4
Environmental Science English /MIL Communication		
2. Skill Enhancement Courses (SEC)		
(Minimum2)	2×2 =4	2×2=4
(2Papersof 2crediteach)		
Total credit	140	140

Institute should evolve a system/policy about ECA/General Interest /Hobby /Sports /NCC /NSS /related courses on its own.

***wherever there is a practical there will be no tutorial and vice-versa**

Proposed Scheme for Choice Based Credit System

B.Sc.(Hons.)Mathematics

Semester	Core Course (14)	Ability Enhancement Compulsory Course (AECC) (2)	Skill Enhancement Course (SEC) (2)	Discipline Specific Elective (DSE) (4)	Generic Elective (GE) (4)
1	C1: Calculus	AECC1			GE1
	C2: Probability and Statistical Methods				
2	C3: Real Analysis	AECC2			GE2
	C4: Differential Equations				
3	C5: Theory of Real Functions		SEC1		GE3
	C6: Group Theory I				
	C7: PDE and Systems of ODE				
4	C8: Numerical Methods (P)		SEC2		GE4
	C9: Riemann Integration and Series of Functions				
	C10: Ring Theory and Linear Algebra I				

	C12: Group Theory II			**DSE-2**	
6	**C13: Metric Spaces and Complex Analysis**			**DSE-3**	
	C14: Ring Theory And Linear Algebra II			**DSE-4**	
5	**C11: Multivariate Calculus**			**DSE-1**	

(P) *Means course with practical's*

Discipline Specific Electives (DSE)		
S. No	**Subject Code**	**Subject Name**
01	**STUGM DSE 11**	**Portfolio Optimization**
02	**STUGM DSE 12**	**Number Theory**
03	**STUGM DSE 13**	**Analytical Geometry**
04	**STUGM DSE 21**	**Industrial Mathematics**
05	**STUGM DSE 22**	**Boolean Algebra and Automata Theory**
06	**STUGM DSE 23**	**Algebra**
07	**STUGM DSE 31**	**Theory of Equations**
08	**STUGM DSE 32**	**Bio-Mathematics**
09	**STUGM DSE 33**	**Linear Programming**
10	**STUGM DSE 41**	**Mathematical Modeling**
11	**STUGM DSE 42**	**Mechanics**
12	**STUGM DSE 43**	**Differential Geometry**

Skill Enhancement Course (SEC)		
S. No	**Subject Code**	**Subject Name**
01	**STUGM SEC 11**	**Logic and Sets**
02	**STUGM SEC 12**	**Computer Graphic**
03	**STUGM SEC 21**	**Graph Theory**
04	**STUGM SEC 22**	**Operating System: Linux**

Generic Electives (GE)		
S. No	**Subject Code**	**Subject Name**
01	**STUGM GE 11**	**Fundamentals of Computer Application (with Practical)**
02	**STUGM GE 12**	**Finite Element Methods**
03	**STUGM GE 21**	**Mathematical Finance**
04	**STUGM GE 22**	**Econometrics**
05	**STUGM GE 31**	**Cryptography and Network Security**
06	**STUGM GE 32**	**Information Security**
07	**STUGM GE 41**	**Applications of Algebra**
08	**STUGM GE 42**	**Combinatorial Mathematics**

SEMESTER-I

S. No	Course Code	Subject	Period			Evaluation Scheme					Credit
						Sessional Exam			External Exam	Subject Total	
			L	T	P	CA	TA	Total			
1	STUGM-C01	Calculus	5	1	0	20	20	40	60	100	6
2	STUGM-C02	Probability and Statistical Methods	5	1	0	20	20	40	60	100	6
3	Generic Electives (Choose any one)		4	0	0	20	20	40	60	100	4
	STUGM GE 11	Fundamentals of Computer Application									
	STUGM GE 12	Finite Element Methods									
4	AECC 01	Environmental Science	2	0	0	20	20	40	60	100	2
Practical											
1	SPUGM GE 11	Fundamentals Computer Application (Practical)	0	0	2			25	25	50	2
Total										450	20

SEMESTER II

S. No	Course Code	Subject	Period			Evaluation Scheme					Credit
						Sessional Exam			External Exam	Subject Total	
			L	T	P	CA	TA	Total			
1	STUGM-C03	Real Analysis	5	1	0	20	20	40	60	100	6
2	STUGM-C04	Differential Equations	5	1	0	20	20	40	60	100	6
3	AECC 02	Technical Communication	2	0	0	20	20	40	60	100	2
4	**Generic Electives** (Choose any one)		5	1	0	20	20	40	60	100	6
	STUGM GE 21	Mathematical Finance									
	STUGM GE 22	Econometrics									
Total										400	20

SEMESTER III

S. No	Course Code	Subject	Period			Evaluation Scheme					Credit
						Sessional Exam			External Exam	Subject Total	
			L	T	P	CA	TA	Total			
1	STUGM-C05	Theory of Real Functions	5	1	0	20	20	40	60	100	6
2	STUGM- C06	Group Theory I	5	1	0	20	20	40	60	100	6
3	STUGM-C07	PDE and Systems of ODE	5	1	0	20	20	40	60	100	6
4	**Skill Enhancement Course** (Choose any one)		2	0	0	20	20	40	60	100	2
	STUGM SEC 11	Logic and Sets									
	STUGM SEC 12	Computer Graphic									
5	**Generic Electives** (Choose any one)		5	1	0	20	20	40	60	100	6
	STUGM GE 31	Cryptography and Network Security									
	STUGM GE 32	Information Security									
Total										500	26

SEMESTER IV

S. No	Course Code	Subject	Period			Evaluation Scheme					Credit
						Sessional Exam			External Exam	Subject Total	
			L	T	P	CA	TA	Total			
1	STUGM-C08	Numerical Methods	5	1	0	20	20	40	60	100	6
2	STUGM-C09	Riemann Integration and Series of Functions	5	1	0	20	20	40	60	100	6
3	STUGM-C10	Ring Theory and Linear Algebra I	5	1	0	20	20	40	60	100	6
4	**Skill Enhancement Course** (Choose any one)		2	0	0	20	20	40	60	100	2
	STUGM SEC 21	Graph Theory									
	STUGM SEC 22	Operating System: Linux									
5	**Generic Electives** (Choose any one)		5	1	0	20	20	40	60	100	6
	STUGM GE 41	Applications of Algebra									
	STUGM GE 42	Combinatorial Mathematics									
Total										500	26

SEMESTER V

S. No	Course Code	Subject	Period			Evaluation Scheme					Credit
						Sessional Exam			External Exam	Subject Total	
			L	T	P	CA	TA	Total			
1	STUGM-C11	Multivariate Calculus	5	1	0	20	20	40	60	100	6
2	STUGM-C12	Group Theory II	5	1	0	20	20	40	60	100	6
3	**Discipline Specific Electives (Choose any one)**		5	1	0	20	20	40	60	100	6
	STUGM-DSE 11	Portfolio Optimization									
	STUGM-DSE 12	Number Theory									
	STUGM-DSE 13	Analytical Geometry									
4	**Discipline Specific Electives (Choose any one)**		5	1	0	20	20	40	60	100	6
	STUGM-DSE 21	Industrial Mathematics									
	STUGM-DSE 22	Boolean Algebra and Automata Theory									
	STUGM-DSE 23	Algebra									
Total										400	24

SEMESTER VI

S. No	Course Code	Subject	Period			Evaluation Scheme					Credit
						Sessional Exam			External Exam.	Subject Total	
			L	T	P	CA	TA	Total			
1	STUGM-C13	Metric Spaces and Complex Analysis	5	1	0	20	20	40	60	100	6
2	STUGM-C14	Ring Theory and Linear Algebra II	5	1	0	20	20	40	60	100	6
3	**Discipline Specific Electives** (Choose any one)		5	1	0	20	20	40	60	100	6
	STUGM-DSE 31	Theory of Equations									
	STUGM-DSE 32	Bio-Mathematics									
	STUGM-DSE 33	Linear Programming									
4	**Discipline Specific Electives** (Choose any one)		5	1	0	20	20	40	60	100	6
	STUGM-DSE 41	Mathematical Modeling									
	STUGM-DSE 42	Mechanics									
	STUGM-DSE 43	Differential Geometry									
Total										400	24

OVER ALL SCHEME

S. No.	Semester	Theory Total	Practical	Subject Total	Total Credits
1.	I	400	50	450	20
2.	II	400	-	400	20
3.	III	500	-	500	26
4.	IV	500	-	500	26
5.	V	400	-	400	24
6.	VI	400	-	400	24
Grand Total				2650	140

Course Structure Template

L	T	P
5	1	0

Course Code: STUGM- C01
Course Name: Calculus
Course Credit Hour: 6hr
Total Contact Hour: 70hr

Course Objective:

The objective of studying calculus is simply to introduce your mind to the scientific method of analysis. The student will compute limits, derivatives, and integrals. Analyze functions using limits, derivatives, and integrals.

Course Description:

Students will learn to find higher order derivatives, curve tracing in Cartesian coordinates and its application in business, economics and life sciences, reduction formula, find volume by slicing, disks and washers method, scalar and vector triple product.

Course Contents:

Unit I - Hyperbolic functions, higher order derivatives, Leibniz rule and its applications to problems of type $e^{ax+b}\sin x$, $e^{ax+b}\cos x$, $(ax+b)^n\sin x$, $(ax+b)^n\cos x$, concavity and inflection points, asymptotes, curve tracing in Cartesian coordinates, tracing in polar coordinates of standard curves, L'Hospital's rule, applications in business, economics and life sciences.

Unit II - Reduction formulae, derivations and illustrations of reduction formulae of the type $\int \sin nx\,dx$, $\int \cos nx\,dx$, $\int \tan nx\,dx$, $\int \sec nx\,dx$, $\int (\log x)^n\,dx$, $\int \sin^n x \sin^N x\,dx$, volumes by slicing, disks and washers methods, volumes by cylindrical shells, parametric equations, parameterizing a curve, arc length, arc length of parametric curves, area of surface of revolution. Techniques of sketching conics, reflection properties of conics, rotation of axes and second degree equations, classification into conics using the discriminant, polar equations of conics.

Unit III - Triple product, introduction to vector functions, operations with vector-valued functions, limits and continuity of vector functions, differentiation and integration of vector functions, tangent and normal components of acceleration, modeling ballistics and planetary motion, Kepler's second law.

Course Learning Outcomes(CLOs) :

CLO-1 : knowledge of Hyperbolic functions

CLO-2 :Knowledge of Reduction formulae

CLO-3 : Knowledge of Triple Product

Text books :

1. G.B. Thomas and R.L. Finney, Calculus, 9th Ed., Pearson Education, Delhi, 2005.

Reference books :

2. M.J. Strauss, G.L. Bradley and K. J. Smith, Calculus, 3rd Ed., Dorling Kindersley (India) P. Ltd. (Pearson Education), Delhi, 2007.
3. R. Courant and F. John, Introduction to Calculus and Analysis (Volumes I & II), SpringerVerlag, New York, Inc., 1989

Online links for study & reference materials :

https://youtu.be/sPvTYIi2A2Q
https://youtu.be/j8XLYFzTJzE

Assessment method :(Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-4	- 05%
Assessment-5	- 05%
Total Internal Assessment	**- 40%**

Course Structure Template

L	T	P
5	1	0

Course Code : STUGM-C02 **Course Name :**Probability and Statistical Methods
Course Credit Hour : 6hr **Total Contact Hour :** 70hr

Course Objective :

Probability and statistics hold the key for enabling our students to better understand, process, and interpret the vast amounts of quantitative data that exist all around them, and to have a probabilistic sense in situations of uncertainty.

Course Description :

Students will learn to distinguish between primary and secondary data, how to find different measures of data, meaning of random variables and different types of probability distribution functions, meaning of regression and types of correlation**.**

Course Contents :

Unit I - Types and Presentation of data: Population and sample, quantitative and qualitative data, cross-sectional and Time-series data, discrete and continuous data, Different types of scales, Primary data – designing a questionnaire and a schedule, Secondary data – its major sources, Complete enumeration, Presentation of data: Construction of Tables, one or more factors of classification, diagrammatic representations, frequency distributions and cumulative frequency distributions and their graphical representations, stem and leaf displays.

Unit II - Theory of Measures: Different measures of location namely mean, median, mode for discrete data and continuous data and their merits and limitations, measures of dispersion-range, Quartiles, standard deviation, variance and coefficient of variance, Moments and measure of skewness and kurtosis based on moments, Box Plots.

Unit III - Random Variables: Random experiments, classical and relative frequency approach to probability, conditional probability, independent events, Bayes theorem and its applications. Discrete and continuous random variables, p.m.f., p.d.f., c.d.f., Expectation of random variable and its properties, Moment generating Function and Cumulant generating Function.

Unit IV - Distribution functions Discrete probability distributions: Degenerate, Bernoulli, Binomial, Poisson, Geometric, Negative Binomial, Geometric, Hypergeometric,Continuous probability distributions- Normal, Uniform, Triangular, Gamma, Beta, Exponential, Laplace, Weibul, Logistic, and Cauchy.

Unit V - Correlation and Regression Analysis: Types of correlation, Karl Pearson Coefficient (r) of correlation, Rank correlation coefficient, assumptions and properties for r, Concept of regression-fitting of straight line using Principle of least squares, properties of regression coefficients, distinction between correlation and regression. Fitting of second degree parabola, power curve of the type $Y=ax^b$, exponential curves of the types $Y=ab^x$ and $Y=ae^{bx}$.

Course Learning Outcomes(CLOs) :

CLO-1 : knowledge of Probability.

CLO-2 : Understands the types of measures and where to apply it.

CLO-3 : Knowledge of Random Variables.

CLO-4 : Knowledge of Discrete and continuous probability distribution.

CLO-5 : Understand the types of correlation and concept of regression.

Text books :

- Gupta, S.C. and Kapoor, V.K. (2007): Fundamentals of Mathematical Statistics, 11th Edn., (Reprint), Sultan Chand and Sons.

Reference books :

- Croxton F.E., Cowden D.J. & Klein (1969): Applied General Statistics, Prentice Hall
- Rohatgi, V. K. and Saleh, A. K. Md. E. (2009): An Introduction to Probability and Statistics, 2 ndEdn. (Reprint). John Wiley and Sons.

Online links for study & reference materials :

https://youtu.be/cqK3uRoPtk0
https://youtu.be/WWv0RUxDfbs

Assessment method :(Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-4	- 05%
Assessment-5	- 05%
Total Internal Assessment	**- 40%**

Course Structure Template

L	T	P
5	1	0

Course Code: STUGM-C04 **Course Name: Differential** Equations
Course Credit Hour: 6hr **Total Contact Hour:** 70hr

Course Objective:

A differential equation is an equation that relates one or more functions and their derivatives. In applications, the functions generally represent physical quantities, the derivatives represent their rates of change, and the differential equation defines a relationship between the two.

Course Description:

This course includes the study of first order differential equations, higher order linear differential equations, Euler's equation, Linear and Bernoulli equations and and applications of differential equations.

Course Contents :

Unit I - Differential equations and mathematical models. General, particular, explicit, implicit and singular solutions of a differential equation. Exact differential equations and integrating factors, separable equations and equations reducible to this form, linear equation and Bernoulli equations, special integrating factors and transformations.

Unit II - Introduction to compartmental model, exponential decay model, lake pollution model (case study of Lake Burley Griffin), drug assimilation into the blood (case of a single cold pill, case of a course of cold pills), exponential growth of population, limited growth of population, limited growth with harvesting

Unit III - General solution of homogeneous equation of second order, principle of super position for homogeneous equation, Wronskian: its properties and applications, Linear homogeneous and non-homogeneous equations of higher order with constant coefficients, Euler's equation, method of undetermined coefficients, method of variation of parameters.

Unit IV - Equilibrium points, Interpretation of the phase plane, predatory-prey model and its analysis, epidemic model of influenza and its analysis, battle model and its analysis.

Course Learning Outcomes(CLOs) :

CLO-1 :The student will be able to explain the concept of differential equation and classifies the Differential equation with respect to their order and linearity.

CLO-2 : Understands different models and their solution.

CLO-3 : Knowledge of second order homogenous equation.

CLO-4 : understand about Equilibrium points and predatory-prey model and its analysis.

Text books :

S.L. Ross, Differential Equations, 3rd Ed., John Wiley and Sons, India, 2004.

Reference books :

1 Belinda Barnes and Glenn R. Fulford, Mathematical Modeling with Case Studies,

2 A Differential EquationApproach using Maple and Matlab, 2nd Ed., Taylor and Francis group, London and New York, 2009.

3 C.H. Edwards and D.E. Penny, Differential Equations and Boundary Value problems Computing and

Modeling, Pearson Education India, 2005.

Online links for study & reference materials :

https://youtu.be/LompT8T-9y4
https://youtu.be/UFWAu8Ptth0

Assessment method :(Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-4	- 05%
Assessment-5	- 05%
Total Internal Assessment	**- 40%**

Course Structure Template

L	T	P
5	1	0

Course Code: STUGM-C03
Course Credit Hour: 6hr

Course Name: Real Analysis
Total Contact Hour: 70hr

Course Objective:

Introduction to Real Analysis will cover algebraic and order properties of the real numbers, the least upper bound axiom, limits, continuity, differentiation, the Riemann integral, sequences, and series. Definitions and proofs will be stressed throughout the course.

Course Description:

A course that develops this basic material in a systematic and rigorous manner in the context of real-valued functions of a real variable. Sequences: convergence, , Cauchy sequences, The Archimedean Property, Bounded Sets. Bolzano-Weierstrass theorem for sets. convergence and divergence of infinite series. Tests for convergence: Convergence and divergence of infinite series.

Course Contents:

Unit I - Review of Algebraic and Order Properties of R, ð-neighborhood of a point in R, Idea of countable sets, uncountable sets and uncountability of R. Bounded above sets, Bounded below sets, Bounded Sets, Unbounded sets, Suprema and Infima, The Completeness Property of R, The Archimedean Property, Density of Rational (and Irrational) numbers in R, Intervals. Limit points of a set, Isolated points, Illustrations of Bolzano-Weierstrass theorem for sets.

Unit II - Sequences, Bounded sequence, Convergent sequence, Limit of a sequence. Limit Theorems, Monotone Sequences, Monotone Convergence Theorem. Subsequences, Divergence Criteria, Monotone Subsequence Theorem (statement only), Bolzano Weierstrass Theorem for Sequences. Cauchy sequence, Cauchy's Convergence Criterion.

Unit III - Infinite series, convergence and divergence of infinite series, Cauchy Criterion, Tests for convergence: Comparison test, Limit Comparison test, Ratio Test, Cauchy's nth root test, Integral test, Alternating series, Leibniz test, Absolute and Conditional convergence.

Course Learning Outcomes(CLOs) :

CLO-1 :The student will find Suprema and Infima of the set

CLO-2 : Understands concept of the convergent sequence

CLO-3 : Knowledge of different types of convergence.

Text books :

R.G. Bartle and D. R. Sherbert, Introduction to Real Analysis, 3rd Ed., John Wiley and Sons (Asia) Pvt. Ltd., Singapore, 2002.

Reference books :

S.K. Berberian, A First Course in Real Analysis, Springer Verlag, New York, 1994.

Brian S. Thomson, Andrew. M. Bruckner and Judith B. Bruckner, Elementary Real Analysis, Prentice Hall, 2001.

Online links for study & reference materials :

https://youtu.be/S-qzRWJOlf8
https://youtu.be/UbNE_beWlhU

Assessment method :(Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-4	- 05%
Assessment-5	- 05%
Total Internal Assessment	**- 40%**

Course Structure Template

L	T	P
5	1	0

Course Code: STUGM-C05 **Course Name:** Theory of Real Functions
Course Credit Hour: 6hr **Total Contact Hour:** 90hr

Course Objective:

The course has a approach of continuous function and its theorem andread and
learn about the rolles theorem.and property define the Taylor's theorem also define Maclaurins series.
its also help to improve the analytical approach to real world.

Course Description:

evaluate, manipulate, and simplify expressions containing basic mathematical functions, such as polynomial, radical, rational, trigonometric, exponential, logarithmic, absolute-valued, composite, piecewise functions (in particular, in expressions containing powers, exponentials and logarithms, perform algebraic manipulations by applying specific properties of such functions.

Course Contents:

UnitI

Limits of functions (c — ð approach), sequential criterion for limits, divergence criteria. Limittheorems, one sided limits. Infinite limits and limits at infinity. Continuous functions, sequentialcriterion for continuity and discontinuity. Algebra of continuous functions. Continuous functionson an interval, intermediate value theorem, location of roots theorem, preservation of intervalstheorem. Uniform continuity, non-uniform continuitycriteria, uniform continuitytheorem.

UnitII

Differentiability of a function at a point and in an interval, Caratheodory's theorem, algebra ofdifferentiable functions. Relative extrema, interior extremum theorem. Rolle's theorem, Meanvalue theorem, intermediate value property of derivatives, Darboux's theorem. Applications ofmean value theorem to inequalities and approximation of polynomials, Taylor's theorem toinequalities.

UnitIII

Cauchy's mean value theorem. Taylor's theorem with Lagrange's form of remainder, Taylor'stheorem with Cauchy's form of remainder, application of Taylor's theorem to convex functions,relativeextrema.Taylor'sseriesandMaclaurin'sseriesexpansionsofexponentialandtrigonometricfunctions, ln(1 +x), 1/ax+b and $(1+x)^n$.

Course Learning Outcomes (CLOs) :

This course will enable the students to:

CLO 1: Assimilatethenotionsoflimitofasequenceandconvergenceofaseriesofrealnumbers.

CLO 2:
Calculatethelimitandexaminethecontinuityofafunctionatapoint.Understandtheconsequencesofvariousmeanvaluetheoremsfordifferentiablefunctions.

CLO 3:
SketchcurvesinCartesianandpolarcoordinatesystems.Applyderivativetestsinoptimizationproblemsappearinginsocialsciences,physicalsciences,lifesciencesandahostofotherdisciplines.

Text books :

1. R.Bartle andD.R. Sherbert,*Introduction to RealAnalysis*, JohnWileyandSons,2003.
2. K.A.Ross,*ElementaryAnalysis: TheTheoryofCalculus*, Springer,2004.

Reference books :

1. A.Mattuck,*IntroductiontoAnalysis*, PrenticeHall,1999.
2. S.R.Ghorpade andB.V.Limaye,*A Coursein Calculus and Real Analysis,*Springer,2006.

Online links for study & reference materials :
https://nptel.ac.in/courses/111/106/111106053/

Assessment method : (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

Course Structure Template

L	T	P
5	1	0

Course Code: STUGM-C06
Course Credit Hour: 6hr
Course Name: Group Theory -I
Total Contact Hour: 90hr

Course Objective:

To obtain proficiency in the study of symmetries of physical systems, and the use of groups to classify and quantify natural phenomenon.

Course Description:

This is a course in abstract algebra although connections with others fields will be stressed as often as possible. It is a systematic study of the basic structure of groups, finite and infinite.

Course Contents:

UnitI

Symmetriesofasquare,Dihedralgroups,definitionandexamplesofgroupsincludingpermutation groups and quaternion groups (illustration through matrices), elementary propertiesof groups. Subgroups and examples of subgroups, centralizer, normalizer, center of a group,productof two subgroups.

UnitII

Properties of cyclic groups, classification of subgroups of cyclic groups. Cycle notation forpermutations,propertiesofpermutations,evenandoddpermutations,alternatinggroup,propertiesofcosets, Lagrange'stheoremandconsequencesincludingFermat's Littletheorem.

UnitIII

Externaldirectproductofafinitenumberofgroups,normalsubgroups,factorgroups,Cauchy'stheoremforfinite abeliangroups.

UnitIV

Grouphomomorphisms,propertiesofhomomorphisms,Cayley'stheorem,propertiesofisomorphisms,First, Second and Third isomorphism theorems.

Course Learning Outcomes (CLOs) :

After studying this course, you should be able to:

CLO1: explain what is meant by symmetry of a plane figure

CLO2: find the composite of two symmetries; find the inverse of symmetry

CLO3: determine whether a given set and binary operation form a group by checking group axioms

CLO4: describe the symmetries of some bounded three-dimensional figures.

Text books:

1. JohnB. Fraleigh,*A FirstCourse in AbstractAlgebra*, 7thEd., Pearson,2002**.**

2. M.Artin, *Abstract Algebra*,2nd Ed., Pearson,2011.

3. Joseph A. Gallian, *Contemporary Abstract Algebra,* 4th Ed., Narosa Publishing House, NewDelhi,1999.

Reference books:

1. JosephJ.Rotman, *AnIntroduction to the Theory of Groups,*4th Ed., SpringerVerlag,1995.

2. I.N.Herstein,*TopicsinAlgebra*,WileyEasternLimited,India,1975.

Online links for study & reference materials :

https://www.maths.gla.ac.uk/~mwemyss/teaching/3alg1-7.pdf

Assessment method : (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Mid exam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

1. .

Course Structure Template

L	T	P
5	1	0

Course Code : STUGM-C07 **Course Name :** PDE and system of ODE
Course Credit Hour: 6hr **Total Contact Hour:** 90hr

Course Objective:
Apply the fundamental concepts of Ordinary Differential Equations and Partial Differential Equations and the basic numerical methods for their resolution and Solve the problems choosing the most suitable method.

Course Description:
Understand the difficulty of solving problems analytically and the need to use numerical approximations for their resolution.
1.Use computational tools to solve problems and applications of Ordinary Differential Equations and Partial Differential Equations.
2. Formulate and solve differential equation problems in the field of Industrial Organisation Engineering.
3. Use an adequate scientific language to formulate the basic concepts of the course.

Course Contents:

UnitI

Partial Differential Equations – Basic concepts and Definitions, Mathematical Problems. First-OrderEquations:Classification,ConstructionandGeometricalInterpretation.MethodofCharacteristics for obtaining General Solution of Quasi Linear Equations. Canonical Forms ofFirst-order Linear Equations. Method of Separation of Variables for solving first order partialdifferentialequations.

UnitII

Derivation of Heat equation, Wave equation and Laplace equation. Classification of second orderlinear equations as hyperbolic, parabolic or elliptic. Reduction of second order Linear Equationstocanonical forms.

UnitIII

TheCauchyproblem,theCauchy-Kowaleewskayatheorem,Cauchyproblemofaninfinitestring. Initial Boundary Value Problems, Semi-Infinite String with a fixed end, Semi-InfiniteStringwithaFreeend,Equationswithnon-homogeneousboundaryconditions,Non-Homogeneous Wave Equation. Method of separation of variables, Solving the Vibrating StringProblem,Solvingthe Heat Conductionproblem

UnitIV

Systemsoflineardifferentialequations,typesoflinearsystems,differentialoperators,anoperator method for linear systems with constant coefficients, Basic Theory of linear systems innormal form, homogeneous linear systems with constant coefficients: Two Equations in twounknown functions, The method of successive approximations, the Euler method, the modifiedEulermethod, TheRunge-Kutta method.

Course Learning Outcomes (CLOs) :

After the completion of the course, Students will be able to

CLO1. Classify partial differential equations and transform into canonical form, solve linear partial differential equations of both first and second order

CLO2: apply partial derivative equation techniques to predict the behavior of certain phenomena, apply specific methodologies, techniques and resources to conduct research and produce innovative results in the area of specialization.

CLO3: extract information from partial derivative models in order to interpret reality.

CLO4: Identify real phenomena as models of partial derivative equations

Text books :

1. Tyn Myint-U and Lokenath Debnath, *Linear Partial Differential Equations for Scientists andEngineers,*4th edition, Springer,Indianreprint,2006.

2. S.L.Ross,*Differential equations,* 3rdEd., JohnWileyandSons,India,2004.

Reference books :

1. Martha L Abell, James P Braselton, *Differential equations with MATHEMATICA,* 3rd Ed.,ElsevierAcademicPress,2004.

Online links for study & reference materials :
https://nptel.ac.in/courses/111/107/111107111/

Assessment method : (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

Course Structure Template

L	T	P
5	1	0

Course Code: STUGM-C08 **Course Name: Numerical** Methods
Course Credit Hour: 5hr **Total Contact Hour:** 68hr

Course Objective:

The course will also develop an understanding of the elements of error analysis for numerical methods and certain proofs.The main objective of this course is to provide students with an introduction to the field of numerical analysis. Derive appropriate numerical methods to solve interpolation based problems. Derive appropriate numerical integration methods.

Course Description:

This course includes the study of Algorithms, System of linear algebraic equations, Interpolation and numerical Integration Methods.

Course Contents:

Unit I –

Algorithms, Convergence, Errors: Relative, Absolute, Round off, Truncation. Transcendental and Polynomial equations: Bisection method, Newton's method, Secant method. Rate of convergence of these methods.

Unit II

System of linear algebraic equations: Gaussian Elimination and Gauss Jordan methods. Gauss Jacobi method, Gauss Seidel method and their convergence analysis.

Unit III –

Interpolation: Lagrange and Newton's methods. Error bounds. Finite difference operators. Gregory forward and backward difference interpolation.

Unit IV–

Numerical Integration: Trapezoidal rule, Simpson's rule, Simpsons 3/8th rule, Boole's Rule. Midpoint rule, Composite Trapezoidal rule, Composite Simpson's rule. Ordinary Differential Equations: Euler's method. Runge-Kutta methods of orders two and four. Use of Scientific Calculator is allowed.

List of Practicals (using any software)

(i) Calculate the sum 1/1 + 1/2 + 1/3 + 1/4 +---------- + 1/ N.
(ii) To find the absolute value of an integer.
(iii) Enter 100 integers into an array and sort them in an ascending order.
(iv) Bisection Method.
(v) Newton Raphson Method.
(vi) Secant Method.
(vii) RegulaiFalsi Method.
(viii) LU decomposition Method.
(ix) Gauss-Jacobi Method.
(x) SOR Method or Gauss-Siedel Method.
(xi) Lagrange Interpolation or Newton Interpolation.
(xii) Simpson's rule.

Note: For any of the CAS (Computer aided software) Data types-simple data types, floating data types, character data types, arithmetic operators and operator precedence, variables and constant declarations, expressions, input/output, relational operators, logical operators and logical expressions, control statements and loop statements, Arrays should be introduced to the students.

Course Learning Outcomes(CLOs) :

CLO-1: Understand the theoretical and practical aspects of the use of numerical analysis.
CLO-2 :Knowledge of System of linear algebraic equationsand learn different methods to solve
CLO-3 : Knowledge of Lagrange and Newton's Interpolation method
CLO-4 : understand Runge-Kutta methods of orders two and four.

Text books :

Brian Bradie, A Friendly Introduction to Numerical Analysis, Pearson Education, India, 2007.
M.K. Jain, S.R.K. Iyengar and R.K. Jain, Numerical Methods for Scientific and Engineering Computation, 6th Ed., New age International Publisher, India, 2007

Reference books :

Uri M. Ascher and Chen Greif, A First Course in Numerical Methods, 7th Ed., PHI Learning Private Limited, 2013.
John H. Mathews and Kurtis D. Fink, Numerical Methods using Matlab, 4th Ed., PHI Learning Private Limited, 2012.

Online links for study & reference materials :

https://youtu.be/_cgzqVmvqtQ
https://youtu.be/sykjkFF9oWo

Assessment method :(Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-4	- 05%
Assessment-5	- 05%
Total Internal Assessment	**- 40%**

Course Structure Template

L	T	P
5	1	0

Course Code: STUGM-C09 **Course Name: Riemann** Integration and Series of Functions
Course Credit Hour: 5hr **Total Contact Hour:** 68hr

Course Objective:

The student will learn a regular partition of an interval, a Riemann sum for a function on a given interval, convergence of Beta and Gamma functions. Understand the theorems based on continuity and derivability and integrability.

Course Description:

The theory and applications of Riemann Integration of a bounded real valued functions defined on a closed and bounded interval. The improper integration, Beta and Gamma integrals and Differentiation and integration of power series. Pointwise and uniform convergence of sequence of functions.

Course Contents:

Unit I - Riemann integration; inequalities of upper and lower sums; Riemann conditions of integrability. Riemann sum and definition of Riemann integral through Riemann sums; equivalence of two definitions; Riemann integrability of monotone and continuous functions, Properties of the Riemann integral; definition and integrability of piecewise continuous and monotone functions. Intermediate Value theorem for Integrals; Fundamental theorems of Calculus.

Unit II - Improper integrals; Convergence of Beta and Gamma functions.

Unit III - Pointwise and uniform convergence of sequence of functions. Theorems on continuity, derivability and integrability of the limit function of a sequence of functions. Series of functions; Theorems on the continuity and derivability of the sum function of a series of functions; Cauchy criterion for uniform convergence and Weierstrass M-Test.

Unit IV - Limit superior and Limit inferior. Power series, radius of convergence, Cauchy Hadamard Theorem, Differentiation and integration of power series; Abel's Theorem; Weierstrass Approximation Theorem.

Course Learning Outcomes(CLOs) :

CLO-1 : compute specific Riemann sums for a function on a given interval.
CLO-2 : Knowledge of the Convergence of Beta and Gamma functions
CLO-3: Understand Cauchy criterion for uniform convergence and Weierstrass M-Test.
CLO-4 :Learn how to find Limit superior and Limit inferior.

Text books :

K.A. Ross, Elementary Analysis, The Theory of Calculus, Undergraduate Texts in Mathematics, Springer (SIE), Indian reprint, 2004.

Reference books :

R.G. Bartle D.R. Sherbert, Introduction to Real Analysis, 3rd Ed., John Wiley and Sons (Asia) Pvt. Ltd., Singapore, 2002.
Charles G. Denlinger, Elements of Real Analysis, Jones & Bartlett (Student Edition),2011.

Online links for study & reference materials :

https://youtu.be/M67h1pW4Oc4
https://youtu.be/IjhuzA9m5CY

Assessment method :(Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-4	- 05%
Assessment-5	- 05%
Total Internal Assessment	**- 40%**

Course Structure Template

L	T	P
5	1	0

Course Code: STUGM-C10 **Course Name: Ring** Theory and Linear Algebra I
Course Credit Hour: 5hr **Total Contact Hour:** 68hr

Course Objective:

The student will learn to write precise and accurate mathematical definitions of objects in ring theory and Explain the defining properties of a vector space and how find the nullspace, rank, basis of a given matrix.

Course Description:

This course includes the concept of Ring and its properties, Ring homomorphisms and theorms based on Isomorphism. The concept of Vector Space, basis and dimension, Linear transformations, null space, range, rank and nullity of a linear transformation

Course Contents:

Unit I - Definition and examples of rings, properties of rings, subrings, integral domains and fields, characteristic of a ring. Ideal, ideal generated by a subset of a ring, factor rings, operations on ideals, prime and maximal ideals.

Unit II - Ring homomorphisms, properties of ring homomorphisms, Isomorphism theorems I, II and III, field of quotients.

Unit III - Vector spaces, subspaces, algebra of subspaces, quotient spaces, linear combination of vectors, linear span, linear independence, basis and dimension, dimension of subspaces.

Unit IV - Linear transformations, null space, range, rank and nullity of a linear transformation, matrix representation of a linear transformation, algebra of linear transformations. Isomorphisms, Isomorphism theorems, invertibility and isomorphisms, change of coordinate matrix.

Course Learning Outcomes(CLOs) :

CLO-1 :Knowledge of the Ring, Integral domain
CLO-2 : Isomorphism theorems I, II and III,
CLO-3 :Characterize a set of vectors and linear systems using the concept of linear independence
CLO-4 :Solve linear systems represented as linear transforms

Text books :

1. S. Kumaresan, Linear Algebra- A Geometric Approach, Prentice Hall ofIndia,1999.

2. Kenneth Hoffman, Ray Alden Kunze, Linear Algebra, 2nd Ed., Prentice-Hall of India Pvt. Ltd., 1971

Reference books :

1. John B. Fraleigh, A First Course in Abstract Algebra, 7th Ed., Pearson, 2002.
2. M. Artin, Abstract Algebra, 2nd Ed., Pearson, 2011

Online links for study & reference materials :

https://youtu.be/a7axWVY8qMY
https://youtu.be/1XlT3Y2oyAU

Assessment method : (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-4	- 05%
Assessment-5	- 05%
Total Internal Assessment	**- 40%**

Course Structure Template

L	T	P
5	1	0

Course Code: STUGM-C11
Course Name: Multivariate Calculus
Course Credit Hour: 6hr
Total Contact Hour: 90hr

Course Objective:
To present the fundamental concepts of multivariable calculus and to develop student understanding and skills in the topic necessary for its applications to science and engineering.

Course Description:

1. Solve mathematical problems using analytical methods.
2. Recognize the relationships between different areas of mathematics and the connections between mathematics and other disciplines.
3. Give clear and organized written and verbal explanations of mathematical ideas to a variety of audiences.

Course Contents :

UnitI

Functionsofseveralvariables,limitandcontinuityoffunctionsoftwovariablesPartialdifferentiation,totaldifferentiabilityanddifferentiability,sufficientconditionfordifferentiability. Chain rule for one and two independent parameters, directional derivatives, thegradient, maximal and normal property of the gradient, tangent planes, Extrema of functions oftwo variables, method of Lagrange multipliers, constrained optimization problems, Definition ofvectorfield, divergenceandcurl

UnitII

Doubleintegrationoverrectangularregion,doubleintegrationovernon-rectangularregion,Double integrals in polar co-ordinates, Triple integrals, Triple integral over a parallelepiped andsolidregions. Volume bytripleintegrals, cylindricaland spherical co-ordinates.

UnitIII

Change of variables in double integrals and triple integrals. Line integrals, Applications of lineintegrals: Mass and Work. Fundamental theorem for line integrals, conservative vector fields,independenceof path.

UnitIV

Green'stheorem,surfaceintegrals,integralsoverparametricallydefinedsurfaces.Stoke'stheorem,The Divergencetheorem.

Course Learning Outcomes (CLOs) : This course will be able the students to:

CLO-1 : Learnconceptualvariationswhileadvancingfromonevariabletoseveralvariablesincalculus. Apply multivariable calculus in optimization problems.

CLO-2 : Inter-relationshipamongstthelineintegral,doubleandtripleintegralformulations.

CLO3: Applications of multivariable calculus tool sin physics, economics, optimization, and understanding the architecture of curves and surfaces in plane and space etc.

CLO-4: Realize importance of Green, Gauss and Stokes's theorems in other branches of mathematics.

Text books:

1. G.B.ThomasandR.L.Finney,*Calculus*,9thEd.,PearsonEducation, Delhi,2005.
2. M.J.Strauss,G.L.BradleyandK. J.Smith,*Calculus,* 3rdEd., DorlingKindersley(India)Pvt.Ltd.(Pearson Education), Delhi,2007.

Reference books :

1. E. Marsden, A.J. Tromba and A. Weinstein, *Basic Multivariable Calculus*, Springer (SIE),Indian reprint,2005.
2. James Stewart, *Multivariable Calculus, Concepts and Contexts*, 2nd Ed., Brooks /Cole,ThomsonLearning, USA,2001.

Online links for study & reference materials :

https://www.whitman.edu/mathematics/multivariable/multivariable.pdf
https://onlinecourses.nptel.ac.in/noc20_ma15/preview

Assessment method : (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

Course Structure Template

L	T	P
5	1	0

Course Code: STUGM-C12
Course Name: Group Theory-II
Course Credit Hour: 6hr
Total Contact Hour: 90hr

Course Objective:

1. Present the relationships between abstract algebraic structures with familiar numbers systems such as the integers and real numbers.
2. Present concepts of and the relationships between operations satisfying various properties (e.g. commutative property).
3. Present concepts and properties of various algebraic structures.
4. Discuss the importance of algebraic properties relative to working within various number systems.
5. Develop the ability to form and evaluate conjectures.

Course Description:

1. **Group action & sylow theorem**
2. **Automorphism and their properties**
3. **Explain Clayey's theorem and simplicity tests**

UnitI

Automorphism, inner automorphism, automorphism groups, automorphism groups of finite andinfinitecyclicgroups,applicationsoffactorgroupstoautomorphismgroups,Characteristicsubgroups,Commutatorsubgroupand its properties.

UnitII

Properties of external direct products, the group of units modulo n as an external direct product,internaldirect products,Fundamental Theorem of finite abeliangroups.

UnitIII

Group actions, stabilizers and kernels, permutation representation associated with a given groupaction,Applicationsof groupactions:GeneralizedCayley'stheorem,Indextheorem.

UnitIV

Groups acting on themselves by conjugation, class equation and consequences, conjugacy in S_n,*p*-groups, Sylow's theorems and consequences, Cauchy's theorem, Simplicity of A_n for $n \geq 5$,non-simplicitytests.

Course Learning Outcomes (CLOs) :

The course will enable the students to:

CLO 1: Recognize the mathematical objects called groups.

CLO 2: Linkthefundamentalconceptsofgroupsandsymmetriesofgeometricalobjects.

CLO 3: Explain the significance of the notions of co-sets, normal subgroups, and factor groups.

CLO 4: Learnaboutstructurepreservingmapsbetweengroupsandtheirconsequences.

Text books :

1. JohnB. Fraleigh, *A FirstCourse in Abstract Algebra*, 7th Ed., Pearson,2002**.**

2. M.Artin,*Abstract Algebra*,2nd Ed.,Pearson,2011.

3. JosephA.Gallian,*ContemporaryAbstractAlgebra,*4thEd.,NarosaPublishingHouse,1999.

Reference books :

1.JohnB. Fraleigh, *A FirstCourse in Abstract Algebra*, 7th Ed., Pearson,2002**.**

2 M.Artin,*Abstract Algebra*,2nd Ed.,Pearson,2011.

3.JosephA.Gallian,*ContemporaryAbstractAlgebra,*4thEd.,NarosaPublishingHouse,1999.

Online links for study & reference materials :

http://home.iitk.ac.in/~chavan/alg1.pdf

Assessment method : (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

Course Structure Template

L	T	P
5	1	0

Course Code: STUGM-C13
Course Credit Hour: 6hr
Course Name: Metric Space & Complex Analysis
Total Contact Hour: 90hr

Course Objective:

To present the fundamental concepts of metric space and complex analysis and to develop student understanding and skills in the topic necessary for its applications to science and engineering.

Course Description:

This course is designed as a basic introductory course in the analysis of metric for undergraduate students. It is aimed at providing the abstract analysis components for the degree course of a student majoring in mathematics. It is assumed that such students will have completed a first course in real analysis or a course in calculus which has been carefully developed with attention given to the real analysis foundations. It is also assumed that the student will have some background in elementary linear algebra. This course affords students majoring in mathematics to gain some familiarity with the axiomatic method in analysis for it provides a logically tight investigation of a basically simple abstract structure which manifests itself in a number of diverse examples.

Course Contents :

UnitI

Metricspaces:definitionandexamples.Sequencesinmetricspaces,Cauchysequences.Complete Metric Spaces. Open and closed balls, neighbourhood, open set, interior of a set. Limitpoint of a set, closed set, diameter of a set, Cantor's theorem. Subspaces, dense sets, separablespaces.

UnitII

Continuous mappings, sequential criterion and other characterizations of continuity. Uniformcontinuity.Homeomorphism,Contractionmappings,BanachFixedpointTheorem.Connectedness,connected subsets of R.

UnitIII

Limits, Limits involving the point at infinity, continuity. Properties of complex numbers, regionsinthecomplexplane,functionsofcomplexvariable,mappings.Derivatives,differentiationformulas,Cauchy-Riemann equations,sufficient conditionsfordifferentiability.

UnitIV

Analytic functions, examples of analytic functions, exponential function, Logarithmic function,trigonometricfunction,derivativesoffunctions,definiteintegralsoffunctions.Contours,Contour integrals and its examples, upper bounds for moduli of contour integrals. Cauchy-Goursattheorem, Cauchyintegral formula.

UnitV

Liouville's theorem and the fundamental theorem of algebra. Convergence of sequences andseries, Taylor series and its examples. Laurent series and its examples, absolute and uniformconvergenceof power series.

Course Learning Outcomes (CLOs) :

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

CLO 1: identify the three properties of a metric or distance;

CLO 2: define the basic terms and concepts in metric space topology;

CLO 3: classify and explain open and closed sets, adherent points, convergent and Cauchy convergent sequences, complete spaces ; compactness and connectedness etc.;

CLO 4: prove logically theorems in metric space topology using the definitions of basic terms and properties of metric spaces.

Text books:

1. SatishShiraliandHarikishanL.Vasudeva,*Metric Spaces*, Springer Verlag,London,2006.
2. S.Kumaresan,*TopologyofMetricSpaces*,2ndEd.,NarosaPublishingHouse,2011.
3. G.F.Simmons,*IntroductiontoTopologyandModernAnalysis*,McGraw-Hill,2004.

Reference books:

3. James Ward Brown and Ruel V. Churchill, *Complex Variables and Applications,* 8th Ed.,McGraw–HillInternational Edition, 2009.
4. Joseph Bak and Donald J. Newman, *Complex Analysis,* 2nd Ed., Undergraduate Texts inMathematics,Springer-VerlagNew York,Inc., NewYork,1997.

Online links for study & reference materials :

https://sites.math.northwestern.edu/~scanez/courses/320/notes/metric-spaces.pdf

Assessment method : (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

Course Structure Template

L	T	P
5	1	0

Course Code: STUGM-C14 **Course Name:** Ring Theory &Linear Algebra II
Course Credit Hour: 6hr **Total Contact Hour:** 90hr

Course Objective:
To develop skills and to acquire knowledge on some advanced concepts of Modern Algebra i.e. different algebraic structures, Modules, Prime ideals, prime radical, Jacobson radical in commutative rings, complete ring of quotients, Prime ideal spaces.

Course Description:

Understand the concepts of commutative ring theory and special structure of inner product spaces and norms, orthogonal projections and spectral theorem also discussion with the minimal polynomial for linear operator.

Course Contents:

UnitI

Polynomial rings over commutative rings, division algorithm and consequences, principal ideal domains, factorization of polynomials, reducibility tests, irreducibility tests, Eisenstein criterion,uniquefactorizationinZ[x]**.**Divisibilityinintegraldomains,irreducibles,primes,uniquefactorizationd omains, Euclidean domains.

UnitII

Dual spaces, dual basis, double dual, transpose of a linear transformation and its matrix in the dual basis, annihilators, Eigen spaces of a linear operator, diagonalizability, invariant subspaces and Cayley-Hamilton theorem, the minimal polynomial for a linear operator.

UnitIII

Innerproductspacesandnorms,Gram-Schmidtorthogonalisationprocess,orthogonalcomplements, Bessel's inequality, the Adjoint of a linear operator, Least Squares Approximation, minimal solutions to systems of linear equations, Normal and self-Adjoint operators, Orthogonal projections and Spectral theorem.

Course Learning Outcomes (CLOs) :

The course is designed to meet the following outcomes:

CLO1: Students will be proficient in reading and understanding mathematics.
CLO2: Students will be able to give coherent logical and formal arguments in BOTH written and verbal forms of communication.
CLO3: Students will be able to perform basic computations in group and ring theory.

Text books:

1. JohnB.Fraleigh, *A FirstCourse in Abstract Algebra*, 7th Ed., Pearson,2002**.**

2. M.Artin,*Abstract Algebra*,2nd Ed.,Pearson,2011.

3. JosephA.Gallian,*ContemporaryAbstractAlgebra*,4thEd.,NarosaPublishingHouse,1999.

4. Stephen H. Friedberg, Arnold J. Insel, Lawrence E. Spence, *Linear Algebra,* 4th Ed., Prentice-HallofIndia Pvt.Ltd., New Delhi,2004.

Reference books:

1. S.Lang,*IntroductiontoLinear Algebra,*2ndEd.,Springer,2005.
2. GilbertStrang,*LinearAlgebra anditsApplications*,Thomson,2007.

3 S.Kumaresan,*Linear Algebra- A GeometricApproach*,PrenticeHall ofIndia,1999.

4 KennethHoffman,RayAldenKunze,*LinearAlgebra,*2ndEd.,Prentice-Hallof IndiaPvt.Ltd.,1971.

5 S.H.Friedberg,A.L. InselandL.E.Spence,*LinearAlgebra*,PrenticeHall ofIndiaPvt. Ltd.,2004.

Online links for study & reference materials :

https://www1.maths.leeds.ac.uk/~ppmartin/LEARN/rings/pdf/lecturesLeedsRPF.pdf

Assessment method :(Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

Course Structure Template

L	T	P
5	1	0

Course Code: STUGM-DSE 11 **Course Name:** Portfolio Optimization
Course Credit Hour: 6hr **Total Contact Hour:** 90hr

Course Objective : The art and science of making decisions about investment mix and policy, matching investments to objectives, asset allocation for individuals and institutions, and balancing risk against performance. (Investopedia) There has been a proliferation of new products and strategies in the asset management space in recent years, e.g., smart beta, alternative beta, fundamental indexing, low volatility, and leveraged and inverse ETFs.

Course Description:

This course applies portfolio theory to understand and evaluate these products and strategies in the context of the empirical evidence about return patterns across assets (i.e., the factors such as value/growth, momentum, and carry that drive returns) in multiple markets/asset classes (e.g., US and international equities and bonds, currencies, and commodities). Key questions include: • What factors drive asset returns? Is it risk or mispricing? • Can this structure of returns be used to construct better portfolios and products? • How should the performance of existing products be evaluated given the empirical evidence? The basic theoretical framework is standard portfolio theory, as developed in Foundations of Finance, and its extensions, and the course will rely heavily on Excel modeling using real world data. 2 The course also covers, to a lesser extent, the institutional landscape of the asset management business—the firms (e.g., Blackrock, Vanguard), the vehicles (e.g., mutual funds, ETFs, hedge funds), and the trends (e.g., active vs. passive, fee competition).

Course Contents:

UnitI

Financial markets.Investment objectives.Measuresofreturn andrisk.Typesofrisks.Riskfreeassets.Mutualfunds.Portfolioof assets.Expectedriskand returnofportfolio.Diversification.

UnitII

Mean-variance portfolio optimization- the Markowitz model and the two-fund theorem, risk-freeassetsandonefundtheorem,efficientfrontier.Portfolioswithshortsales.Capitalmarkettheory.

UnitIII

Capitalassets pricingmodel-thecapital marketline, beta ofan asset,betaofaportfolio,securitymarketline.
Indextrackingoptimizationmodels.Portfolioperformanceevaluationmeasures.

Course Learning Outcomes (CLOs) :

After completing the course, students should be able to:

CLO 1: understand the concept of portfolio diversification and its benefits for risk-averse investors,compute optimal mean-variance portfolios,
CLO 2: compute optimal portfolios that take into account alternative risk measures,construct optimal bond portfolios,
CLO 3: factor investing theory,construct empirical test to evaluate the performance of optimal portfolios,understand the limitations of the mean-variance theory.

Text books:

1. F. K. Reilly, Keith C. Brown, *Investment Analysis and Portfolio Management*, 10th Ed.,South-WesternPublishers,2011.
2. H.M. Markowitz, *Mean-Variance Analysis in Portfolio Choice and Capital Markets*,Blackwell,NewYork,1987.

Reference books :

1. M.J.Best, *Portfolio Optimization*,Chapmanand Hall,CRCPress,2010.
2. D.G.Luenberger,*Investment Science*,2nd Ed.,Oxford UniversityPress,2013.

Online links for study & reference materials :

https://sites.google.com/site/mykolababiak/teaching/practical-portfolio-optimization

Assessment method :(Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

Course Structure Template

L	T	P
5	1	0

Course Code: STUGM-DSE 12 **Course Name:** Number Theory
Course Credit Hour: 6hr **Total Contact Hour :** 90hr

Course Objective:

This course addresses the core objectives of critical thinking skills, communication skills, and empirical and quantitative skills
1). evaluate, or solve problems when given a set of circumstances or data. This common core objective will be assessed in the tests, quizzes and final exam.
2) In written, oral, and/or visual communication, A&M-Commerce students will communicate in a manner appropriate to audience and occasion, with an evident message and organizational structure. This common core objective will be assessed using class activities with class discussion, activities involving writing proofs.
3) utilize mathematical functions and empirical principles and processes. This common core objective will be assessed using class activities, homework problems, tests and a final exam.

Course Description:

Mathematical induction, divisibility, prime numbers, congruences, factorization, arithmetic functions, quadratic reciprocity, primitive roots, Diophantine equations.

COURSE CONTENT:

UnitI

Linear Diophantine equation, prime counting function, statement of prime number theorem,Goldbach conjecture, linear congruences, complete set of residues, Chinese Remainder theorem,Fermat's Littletheorem,Wilson'stheorem.

UnitII

Numbertheoreticfunctions,sumandnumberofdivisors,totallymultiplicativefunctions,definition and properties of the Dirichlet product, the Mobius Inversion formula, the greatestinteger function, Euler's phi-function, Euler's theorem, reduced set of residues, some propertiesofEuler'sphi-function.

UnitIII

Order of an integer modulo n, primitive roots for primes, composite numbers having primitiveroots, Euler's criterion, the Legendre symbol and its properties, quadratic reciprocity, quadraticcongruences with composite moduli. Public key encryption, RSA encryption and decryption, theequation$x^2+y^2=z^2$, Fermat'sLasttheorem.

Course Learning Outcomes(CLOs) :

This course will enable the students to:

CLO 1: Learn about some important results in the theory of numbers including the primenumbertheorem,Chineseremaindertheorem,Wilson'stheoremandtheirconsequences.

CLO 2: Learn about number the or etic functions, modular arithmeticandtheirapplications. Familiarise with modulararithmeticandfindprimitiverootsofprimeandcompositenumbers.

CLO 3: Know about open problems in number theory, namely, the Gold bach conjecture and twin-prime conjecture. Apply public cryptosystems, in particular ,RSA.

Text books :

1. DavidM.Burton,*ElementaryNumberTheory,*6thEd.,TataMcGraw-Hill, Indianreprint,2007.
2. NevilleRobinns,*BeginningNumberTheory,*2ndEd.,NarosaPublishingHousePvt. Ltd.,Delhi,2007.

Reference books :

1. I.Niven(2012).*AnIntroductiontotheTheoryofNumbers*(5th edition).JohnWiley&Sons.
2. NealKoblitz(1994).*ACourseinNumberTheoryandCryptography*(2nd edition).Springer-Verlag.

Online links for study & reference materials :
https://math.unm.edu/~buium/unt.pdf

Assessment method :(Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

Course Structure Template

L	T	P
5	1	0

Course Code: STUGM-DSE 13 **Course Name:** Analytical Geometry
Course Credit Hour: 6hr **Total Contact Hour:** 90hr

Course Objective:

This is a course designed for middle school teachers interested in deepening their conceptual understanding of the geometry taught in middle grades classrooms. It is part of the required course content sequence for undergraduates seeking a concentration in mathematics as part of their middle school licensure.

Course Description:

Topics will include dynamic geometry integrating use of computer software such as Cabri, and geometer's sketchpad; some basic geometry theorems and constructions using compasses, paper folding, or appropriate computer software; similarity, proportion, scaling, and geometric growth; tessellations; simple trigonometric and triangle relationships; van Hiele levels of geometric thought; geometric modeling and networking as problem solving tools; linear, 2D and 3D measurement; fractals & chaos; graphical representations; transformational geometry; and coordinate geometry with algebraic relationships (analytic geometry).

COURSE CONTENT:

UnitI

Techniques for sketching parabola,ellipse and hyperbola. Reflection properties of parabola, ellipse and hyperbola.

UnitII

Classification of quadratic equations representing lines, parabola, ellipse and hyperbola.

UnitIII

Spheres, Cylindrical surfaces. Illustrations of graphing standard quadric surfaces like cone, ellipsoid.

Course Learning Outcomes (CLOs) : The students will be able to

CLO 1: Parameterize curves, evaluate the distance and angle.
CLO 2: sketch conic sections, identify conic sections.
CLO 3: determine congruent conics, classify quadratic equations.

Text books:

1. G.B.ThomasandR.L.Finney,*Calculus*,9thEd.,PearsonEducation, Delhi,2005.
2. H.Anton,I.BivensandS. Davis,*Calculus*,JohnWileyandSons (Asia)Pvt.Ltd.2002.

Reference books :

1. S.L.Loney,*TheElements of CoordinateGeometry*, McMillan andCompany,London.
2. R.J.T. Bill, *Elementary Treatise on Coordinate Geometry of Three Dimensions*, McMillan IndiaLtd., 1994

Online links for study & reference materials :

https://www.britannica.com/science/analytic-geometry

Assessment method :(Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

Course Structure Template

L	T	P
5	1	0

Course Code: STUGM- DSE 21
Course Name: Industrial Mathematics
Course Credit Hour: 6hr
Total Contact Hour: 90hr

Course Objective: This is the second course in the calculus series for science and engineering students. In this course, we are going to integration techniques as well as applications of integrals, parametric curves in a plane, as well as infinite sequences and series.

Course Description: This course is aligned with the following Applied Mathematics program learning outcomes:
1. Solve mathematical problems using analytical methods.
2. Recognize the relationships between different areas of mathematics and the connections between mathematics and other disciplines.
3. Give clear and organized written and verbal explanations of mathematical ideas to a variety of audiences.

COURSE CONTENT:

Unit I

Medical Imaging and Inverse Problems. The contents based on Mathematics of X-rayandCTscanbasedontheknowledgeofcalculus,elementarydifferentialequations,complexnumbers and matrices.

Unit II

Introduction to Inverse problems: Why should we teach Inverse Problems? Illustration of Inverse problems through problems taught in Pre-Calculus, Calculus, Matrices and differential equations. Geological anomalies in Earth's interior from measurements at its surface (Inverse problems for Natural disaster) and Tomography.

Unit III

X-ray: Introduction, X-ray behavior and Beers Law (The fundament question of image construction) Lines in the place.

Radon Transform: Definition and Examples, Linearity, Phantom (Shepp - Logan Phantom - Mathematical phantoms).Back Projection: Definition, properties and examples. CT Scan: Revision of properties of Fourier and inverse Fourier transforms and applications oftheirpropertiesinimagereconstruction.AlgorithmsofCTscanmachine.Algebraicreconstructiontec hniques abbreviated as ART with application to CT scan.

Course Learning Outcomes(CLOs) : Upon completion of this course, students should be able to:

CLO 1. Compute a given integral using the most efficient method;

CLO 2. Use integrals to formulate and solve application problems in science and engineering; Construct and plot parametric and polar curves;

CLO 3. Identify different types of series and determine whether a a particular series converges; Find the interval of convergence of a power series & Apply Taylor series to approximate functions and estimate the error of approximation.

Text books :

1. Timothy G. Feeman, *The Mathematics of Medical Imaging, A Beginners Guide*, SpringerUnder graduate Text in Mathematics and Technology,Springer,2010.
2. C.W .Groetsch, *InverseProblems*, Activities for Undergraduates, The Mathematical Association of America,1999.

Reference books :

1. Andreas Kirsch, *An Introduction to the Mathematical Theory of Inverse Problems*, 2nd Ed.,Springer,2011.

Online links for study & reference materials :
https://guides.library.uoit.ca/math/books

Assessment method :(Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

Course Structure Template

L	T	P
5	1	0

Course Code: STUGM-DSE 22 **Course Name:** Boolean Algebra & Automata Theory
Course Credit Hour : 6hr **Total Contact Hour :** 90hr

Course Objective :

Create a hypothesis and appreciate how it relates to broader theories.
1• Evaluate hypotheses, theories, methods and evidence within their proper contexts.
2• Solve complex problems by critical understanding, analysis and synthesis.
3• Demonstrate engagement with current research and developments in the subject.

Course Description:

Select, interpret and critically evaluate information from a range of sources that include books, scientific reports, journals, case studies and the internet.

1• Develop proficiency in the analysis of complex physical problems and the use of mathematical or other appropriate techniques to solve them.

2• Provide a systematic understanding of the concepts and theories of mathematics and their application in the real world – to an advanced level, and enhance career prospects in a huge array of fields.

3• Criticize mathematical arguments developed by themselves and others

4• Communicate effectively by oral, written, computing and graphical means.

5• Recognize the need to engage in lifelong learning through continuing education and research

COURSE CONTENT:

UnitI

Definition, examples and basic properties of ordered sets, maps between ordered sets, dualityprinciple,latticesasorderedsets,latticesasalgebraicstructures,sublattices,productsandhomomorphisms.Definition,examplesandpropertiesofmodularanddistributivelattices,Booleanalgebras,Booleanpolynomials,minimalformsofBooleanpolynomials,Quinn-McCluskeymethod,Karnaughdiagrams,switchingcircuitsandapplicationsofswitchingcircuits.

UnitII

Introduction:Alphabets,strings,andlanguages.FiniteAutomataandRegularLanguages:deterministic and non-deterministic finite automata, regular expressions, regular languages andtheirrelationshipwithfiniteautomata,pumpinglemmaandclosurepropertiesofregularlanguages.

Context Free Grammars and Pushdown Automata: Context free grammars (CFG), parse trees, ambiguities in grammars and languages, pushdown automaton (PDA) and the language accepted by PDA, deterministic PDA, Non- deterministic PDA, properties of context free languages; normal forms, pumping lemma, closure properties, decision properties.

Unit III

Turing Machines: Turing machine as a model of computation, programming with a Turing machine, variants of Turing machine and their equivalence.

Undesirability: Recursively enumerable and recursive languages, undesirable problems about Turing machines :halting problem, Post Correspondence Problem, and undesirability .

Course Learning Outcomes(CLOs) : Students will able to

CLO 1: Define Automata anddiscuss the acceptability of a string by finite automation

CLO 2: Construct non-deterministic finite state machine

CLO 3: Analyze different simplification methods for Boolean functions and design the logical circuits.

Text books:

1. B A. Davey and H. A. Priestley, *Introduction to Lattices and Order*, Cambridge UniversityPress,Cambridge,1990.

2. EdgarG.GoodaireandMichaelM.Parmenter,*DiscreteMathematicswithGraphTheory,* (2ndEd.),PearsonEducation(Singapore)P.Ltd., IndianReprint2003.

3. Rudolf Lidl and Günter Pilz, *Applied Abstract Algebra*, 2nd Ed., Undergraduate Texts inMathematics,Springer(SIE),Indian reprint,2004.

Reference books:

1. J.E.Hopcroft,R.MotwaniandJ.D.Ullman, *IntroductiontoAutomataTheory,Languages,andComputation,* 2nd Ed., Addison-Wesley,2001.

2. H.R. Lewis, C.H. Papadimitriou, C. Papadimitriou, *Elements of the Theory of Computation*,2ndEd., Prentice-Hall, NJ,1997.

3. J.A.Anderson, *Automata Theory with Modern Applications*, CambridgeUniversityPress,2006.

Online links for study & reference materials:

https://www.vssut.ac.in/lecture_notes/lecture1423726104.pdf

Assessment method:(Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

Course Structure Template

L	T	P
5	1	0

Course Code : STUGM-DSE 23
Course Name : Algebra
Course Credit Hour : 6hr
Total Contact Hour : 90hr

Course Objective:

1 To classify numbers into number sets and to combine polynomial by addition or subtraction.

2 solve problems of simple Inequalities of Eigenvalues, Eigen Vectors and

Characteristic Equation of a matrix.

3 Interpret basic absolute value expression and to simplify algebraic expressions, using the commutative, associative and Distributive properties.

Course Description:

Algebra is a branch of mathematics that substitutes letters for numbers. Algebra is about finding the unknown or putting real-life variables into equations and then solving them. Algebra can include real and complex numbers, matrices, and vectors. An algebraic equation represents a scale where what is done on one side of the scale is also done to the other and numbers act as constants.

COURSE CONTENT:

UnitI

Polar representation of complex numbers, n^{th} roots of unity, De Moivre's theorem for rationalindicesandits applications.

UnitII

Equivalence relations, Functions, Composition of functions, Invertible functions, One to onecorrespondence and cardinality of a set, Well-ordering property of positive integers, Divisionalgorithm,DivisibilityandEuclideanalgorithm,Congruencerelationbetweenintegers,PrinciplesofMathematicalInduction,statement of FundamentalTheoremofArithmetic.

UnitIII

Systems of linear equations, row reduction and echelon forms, vector equations, the matrixequationAx=b,solutionsetsoflinearsystems,applicationsoflinearsystems,linearindependence.

UnitIV

Introduction to linear transformations, matrix of a linear transformation, inverse of a matrix,characterizations of invertible matrices. Subspaces of R^n, dimension of subspaces of R^n and rankofamatrix, Eigenvalues, Eigen Vectorsand Characteristic Equationofamatrix.

.

Course Learning Outcomes(CLOs) : This course will enable the students to:

CLO 1: Understand the basic concepts of group actions and their applications.

CLO 2: RecognizeandusetheSylowtheoremstocharacterizecertainfinitegroups.

CLO 3: Know the fundamental concepts in ring theory such as the concepts of ideals ,quotient rings, integral domains ,and fields.

CLO 4: Learn in detail about polynomial rings, fundamental properties off initial extensions, and classification off invite fields.

Text books :

1. N.S.Gopalakrishnan(1986).*UniversityAlgebra*,NewAgeInternationalPublishers.
2. I.N.Herstein(2006).*TopicsinAlgebra*(2nd edition).WileyIndia.

Reference books :

1. DavidC.Lay,*LinearAlgebraanditsApplications,*3rdEd.,PearsonEducationAsia, IndianReprint,2007.
2. NathanJacobson(2009).*BasicAlgebraI&II*(2ndedition).DoverPublications.

Online links for study & reference materials :

https://www.researchgate.net/publication/312368538_Advanced_Algebra

Assessment method :(Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

Course Structure Template

L	T	P
5	1	0

Course Code: STUGM- DSE 31 **Course Name:** Theory of Equations
Course Credit Hour: 6hr **Total Contact Hour :** 90hr

Course Objective:

In algebra the **theory of equations** is the study of algebraic equation (also called "polynomial equations"), which are equations defined by a polynomials The main problem of the theory of equations was to know when an algebraic equation has an algebraic solution. This problem was completely solved in 1830 by Evariste Galois by introducing what is now called Galois Theory.

Before Galois, there was no clear distinction between the "theory of equations" and "algebra". Since then algebra has been dramatically enlarged to include many new subareas, and the theory of algebraic equations receives much less attention. Thus, the term "theory of equations" is mainly used in the context of the history of mathematics, to avoid confusion between old and new meanings of "algebra"

Course Description:

In this module, we will study about polynomial functions and various methods to find out the roots of polynomial equations. 'Solving equations' was an important problem from the beginning of study of Mathematics itself. The notion of complex numbers was first introduced because equations like $x^2 + 1 = 0$ has no solution in the set of real numbers. The "fundamental theorem of algebra" which states that every polynomial of degree >1 has at least one zero was first proved by the famous German Mathematician Karl Fredrich Gauss. We shall look at polynomials in detail and will discuss various methods for solving polynomial equations.

Course Contents:

UnitI

General properties of polynomials, Graphical representation of a polynomial, maximum andminimum values of a polynomials, General properties of equations, Descarte's rule of signspositiveand negativerule,Relation between theroots and thecoefficientsofequations.

UnitII

Symmetricfunctions,Applicationsofsymmetricfunctionoftheroots,Transformationofequations.Solutions of reciprocal and binomial equations.Algebraic solutions of the cubic andbiquadratic.Properties ofthe derived functions.

UnitIII

Symmetricfunctionsoftheroots,Newton'stheoremonthesumsofpowersofroots,homogeneous products, limits of the roots of equations. Separation of the roots of equations,Strums theorem,

Applications of Strum's theorem, Conditions for reality of the roots of anequationand biquadratic.Solution of numerical equations.

Course Learning Outcomes (CLOs) :

Upon completion of this chapter, the students will be able to

CLO 1: form polynomial equations satisfying given conditions on roots.determine the number of positive and negative roots of a polynomial equation using Descartes Rule.

CLO 2: demonstrate the techniques to solve polynomial equations of higher degree.identify and solve reciprocal equations.

CLO 3: solve equations of higher degree when some roots are known to be complex or surd, irrational, and rational.find solutions to some non-polynomial equations using techniques developed for polynomial equations.

Text books :

1.W.S.Burnside andA.W. Panton,*The Theory of Equations*,Dublin UniversityPress,1954.

Reference books :

1.C.C.MacDuffee,*Theoryof Equations*,John Wiley&SonsInc.,1954

Online links for study & reference materials :

https://www.britannica.com/science/mathematics/Theory-of-equations

Assessment method :(Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

Course Structure Template

L	T	P
5	1	0

Course Code: STUGM-DSE 32
Course Name: Bio-Mathematics
Course Credit Hour: 6hr
Total Contact Hour: 90hr

Course Objective:

By answering questions that cannot be addressed by other means, mathematics can be an indispensable tool for biological research. The interdisciplinary field of mathematical biology combines experiment, mathematical theory, statistics and computation to better understand biological systems. In this course you will engage in all of these areas by collecting data and implementing the essential modeling techniques of formulation, implementation, validation, and analysis. These tools will be applied to a wide variety of biological systems and disciplines.

Course Description:

Course have an enhanced knowledge and understanding of mathematical modeling and statistical methods in the analysis of biological systems; be better able to assess biological inferences that rest on mathematical and statistical arguments; be able to analyses data from experiments and draw sound conclusions about the under lying processes using their understanding of mathematics and statistics; be aware of the use of computers to assist them in studying mathematical functions and carrying out statistical tests.

Course Contents:

Unit I

Mathematical Biology and the modeling process: an overview. Continuous models: Malthus model, logistic growth, Allee effect, Gompertz growth, Michaelis-Menten Kinetics, Holling typegrowth, Bacterial growth in a Chemostat, Harvesting a single natural population, Prey predatorsystems and LotkaVolterra equations, Populations in competitions, Epidemic Models (SI, SIR,SIRS, SIC), Activator-Inhibitor system, Insect Outbreak Model: Spruce Budworm, Numericalsolutionof themodels and its graphical representation.

Unit II

Qualitative analysis of continuous models: Steady state solutions, stability and linearization,multiple species communities and Routh-Hurwitz Criteria, Phase plane methods and qualitativesolutions, bifurcations and limit cycles with examples in the context of biological scenario.Spatial Models: One species model with diffusion, Two species model with diffusion, Conditionsfordiffusiveinstability,Spreadingcoloniesofmicroorganisms,Bloodflowincirculatorysystem,Travelling wavesolutions, Spread of genesin a population.

Unit III

Discrete Models: Overview of difference equations, steady state solution and linear stabilityanalysis, Introduction to Discrete Models, Linear Models, Growth models, Decay models, DrugDeliveryProblem,DiscretePrey-Predatormodels,Densitydependentgrowthmodelswithharvesting, Host-Parasitoid systems (Nicholson-Bailey model), Numerical solution of the modelsand its graphical

representation. Case Studies: Optimal Exploitation models, Models in Genetics, Stage Structure Models, Age Structure Models.

Course Learning Outcomes (CLOs) :

By the end of this course, students should be able to:

CLO1: Formulate discrete and differential equation models that represent a range of biological Problems, including identifying assumptions that are appropriate for the problem to be Solved. Choose and apply computational tools to perform parameter estimation and to solve Discrete and differential equation models.

CLO2: Interpret model and data output in terms of the original biological problem, and use results to Direct a follow-up experiment. Perform appropriate data manipulations, and graphically display model output and data clearly and accurately.

CLO3: Effectively communicate across the disciplines. Demonstrate appropriate laboratory Technique, designs an experiment, and collects data.

Text books :

1. L.E.Keshet,*Mathematical ModelsinBiology*, SIAM,1988.
2. J.D.Murray, *MathematicalBiology*, Springer,1993.
3. Y.C.Fung,*Biomechanics*,Springer-Verlag,1990.

Reference books :

1. F.Brauer, P.V.D. Driesscheand J. Wu,*Mathematical Epidemiology*, Springer,2008.
2. M.Kot,*ElementsofMathematical Ecology*,CambridgeUniversityPress,2001.

Online links for study & reference materials :

https://nptel.ac.in/courses/102/101/102101003/

Assessment method :(Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

Course Structure Template

L	T	P
5	1	0

Course Code: STUGM-DSE 33
Course Name: Linear Programing
Course Credit Hour: 6hr
Total Contact Hour : 90hr

Course Objective:

This course presents the theory, application, and algorithms relevant to solving linear programming problems.
1)Be able to mathematically formulate an applied word problem involving revenue, costs, and constraints as a linear program.
2) Be able to geometrically solve a linear program in two variables.
3) Be able to convert a linear programing problem into standard form.
4) Be able to apply the simplex algorithm to solve a linear programming problem

Course Description:

An introduction to the concepts and applications of linear programming. Topics include the simplex method for linear programming, duality and sensitivity analysis. Some of these topics are illustrated by means of interactive computer packages.

Course Contents:

Unit I

Introductiontolinearprogrammingproblem,Theoryofsimplexmethod,optimalityandunboundedness ,the simplex algorithm,simplexmethodintableauformat,introductiontoartificialvariables, two-phase method, Big-M method and their comparison.

Unit II

Duality, formulation of the dual problem, primal-dual relationships, economic interpretation of the dual.

Unit III

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

Unit IV

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

Course Learning Outcomes (CLOs) :

At the end of the module the student will be able to

CLO 1. Formulate the LPP. Conceptualize the feasible region.

CLO 2. Solve the LPP with two variables using graphical method. Solve the LPP using simplex method.

CLO 3. Formulate the dual problem from primal.

CLO 4:Analyse the sensitivity of a decision variable. Run and analyse the results of user friendly software for LPP

Text books :

1. Mokhtar S. Bazaraa, John J. Jarvis and Hanif D. Sherali, *Linear Programming and NetworkFlows,*2nd Ed., JohnWileyand Sons,India,2004.

2. F.S. Hillier and G.J. Lieberman, *Introduction to Operations Research,* 9th Ed., Tata McGrawHill,Singapore,2009.

Reference books :

1. HamdyA.Taha, *OperationsResearch,AnIntroduction,*8thEd.,Prentice-HallIndia,2006.
2. G.Hadley,*LinearProgramming*, NarosaPublishing House, NewDelhi,2002.

Online links for study & reference materials :

https://www.teachengineering.org/lessons/view/cub_linear_programming_lesson01

Assessment method :(Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

Course Structure Template

L	T	P
5	1	0

Course Code: STUGM-DSE 41
Course Name: Mathematical Modeling
Course Credit Hour: 6hr
Total Contact Hour: 90hr

Course Objective:

The overall goal of this course is to enable students to build mathematical models of real-world systems, analyze them and make predictions about behavior of these systems. Variety of modeling techniques will be discussed with examples taken from physics, biology, chemistry, economics and other fields. The focus of the course will be on seeking the connections between mathematics and physical systems, studying and applying various modeling techniques to creating mathematical description of these systems, and using this analysis to make predictions about the system's behavior.
.

Course Description:

This course is aligned with the following Applied Mathematics program learning outcomes: 1) Solve mathematical problems using analytical methods. 2) Solve mathematical problems using computational methods. 3) Recognize the relationships between different areas of mathematics and the connections between mathematics and other disciplines. 4) Give clear and organized written and verbal explanations of mathematical ideas to a variety of audiences. 5) Model real-world problems mathematically and analyze those models using their mastery of the core concepts.

Course Contents:

Unit I

Power series solution of a differential equation about an ordinary point, solution about a regular singular point, Bessel'sequationandLegendre'sequation,Laplacetransformandinversetransform,application to initial value problem up to second order.

Unit II

Monte Carlo Simulation Modeling: simulating deterministic behavior (are a underacurve, volume under a surface), Generating Random Numbers: middles qu are method, linear congruence, Queuing Models: harbor system, morning rush hour.

Unit III

Overview of optimization modeling, Linear Programming Model: geometric solution algebraic solution, simplex method, sensitivity analysis

List of Practicals (using any software)

(i) Plottingof Legendrepolynomialforn=1to5intheinterval[0,1].
Verifyinggraphicallythat all the rootsof Pn (x) lie intheinterval[0,1].
(ii) Automatic computation of coefficients in theseries solution nearordinarypoints.
(iii) Plottingof theBessel'sfunction offirstkind oforder0 to3.
(iv) Automatingthe FrobeniusSeriesMethod.
(v) Randomnumbergeneration andthenuseitforoneofthefollowing(a)Simulateareaunderacurve(b) Simulate volume under asurface.
(vi) Programmingof either oneofthequeuingmodel(a)Singleserver queue(e.g.Harborsystem)(b) Multiple server queue(e.g. Rushhour).
(vii) Programmingof theSimplexmethod for2/3variables.

Course Learning Outcomes (CLOs) :

On successful completion of this unit, students will be able to:

CLO1. Demonstrate understanding of powerful mathematical tools such as calculus of several variables, differential equations and elementary dynamical systems theory;

CLO2. Compute with these tools, manually and with mathematical software;

CLO3. Apply these tools to mathematically analyse and solve contemporary problems of both theoretical and practical importance;

CLO4. Recognise the power of mathematical modelling and analysis and be able to apply their understanding to their further studies.

Text books :

1. TynMyint-U andLokenathDebnath, *LinearPartialDifferentialEquationforScientistsandEngineers*,Springer,Indian reprint,2006.

Reference books :

1. Frank R. Giordano, Maurice D. Weir and William P. Fox, *A First Course in MathematicalModeling*,ThomsonLearning,London andNew York,2003.

Online links for study & reference materials :

https://www.ntnu.edu/studies/courses/TMA4195#tab=omEmnet

Assessment method :(Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

Course Structure Template

L	T	P
5	1	0

Course Code: STUGM-DSE 42 **Course Name:** Mechanics
Course Credit Hour: 6hr **Total Contact Hour:** 90hr

Course Objective:

The primary purpose of the study of mechanics is to develop the capacity to predict the effects of force and motion while carrying out the creative design functions of engineering. This capacity requires more than a mere knowledge of the physical and mathematical principles of mechanics; also required is the ability to visualize physical configurations in terms of real materials, actual constraints ,and the practical limitations which govern the behavior of machines and structures. One of the primary objectives in a mechanics course is to help the student develop this ability to visualize, which is so vital to problem formulation. Indeed, the construction of a meaningful mathematical model is often a more important experience than its solution. Maximum progress is mad e when the principles and their limitations are learned together within the context of application.

Course Description:

Introduction: course layout and physics revision.
2 Mass geometry: center of mass and moment of inertia tensor.
3 Kinematics: kinds of motion, absolute and relative velocities and accelerations, Coriolis acceleration, instant center of rotation, degrees of freedom.
4 Statics: free body diagram, joints and reactions, friction, work and energy, virtual work, mechanical efficiency.
5 Dynamics: conservation of linear momentum, angular momentum and energy, variable mass systems, dynamic equilibrium, rotor balancing, gyroscopes.
6 Machine theory: degrees of freedom and motion parameters, gear trains, dimensions of mechanisms.

Course Contents :

Unit I

Moment of a force about a point and an axis, couple and couple moment, Moment of a couple about a line, resultant of a force system, distributed force system, free body diagram, free bodyinvolvinginteriorsections,generalequationsofequilibrium,twopointequivalentloading,problemsarising from structures, static indeterminacy.

Unit II

Laws of Coulomb friction, application to simple and complex surface contact friction problems, transmission of power through belts, screw jack, wedge, first moment of an area and the centroid, other centers, Theorem of Pappus-Guldinus, second moments and the product of area ofa plane area, transfer theorems, relation between second moments and products of area, polar moment of area, principal axes.

Unit III

Conservative force field, conservation for mechanical energy, work energy equation, kinetic energy and work kinetic energy expression based on center of mass, moment of momentum equation for a single particle and a system of particles, translation and rotation of rigid bodies,

Chasles'theorem,generalrelationshipbetweentimederivativesofavectorfordifferentreferences, relationship between velocities of a particle for different references, acceleration of particle for different references.

Course Learning Outcomes (CLOs) :

Students will be able to articulate and describe:

CLO 1: Relative motion. Inertial andnon inertial reference frames.Parameters defining the motion of mechanical systems and their degrees of freedom.

CLO 2: Study of the interaction of forces between solids in mechanical systems. Centre of mass and inertia tensor of mechanical systems. 5 Application of the vector theorems of mechanics and interpretation of their results.

CLO 3: Newton's laws of motion and conservation principles.Introduction to analytical mechanics as a systematic tool for problem solving.

Text books :

1. I.H.ShamesandG.KrishnaMohanRao, *EngineeringMechanics:Statics andDynamics,*(4thEd.),DorlingKindersley(India)Pvt.Ltd.(PearsonEducation),Delhi,2009.

Reference books :

1. R.C. Hibbeler and Ashok Gupta, *Engineering Mechanics: Statics and Dynamics,* 11th Ed.,DorlingKindersley(India)Pvt.Ltd. (Pearson Education),Delhi.

Online links for study & reference materials :

https://nptel.ac.in/courses/112/106/112106286/

Assessment method :(Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

Course Structure Template

L	T	P
5	1	0

Course Code: STUGM-DSE 43 **Course Name:** Differential Geometry
Course Credit Hour: 6hr **Total Contact Hour:** 90hr

Course Objective:

1• Introducing the concepts: Regular curves, arc length, and natural parameterization.
2• Introducing the concepts: Serret-Fernet apparatus.
3• Introducing the concepts: Simple surfaces, tangent vectors and tangent spaces, and first and second fundamental forms.
4• Introducing the concepts: Normal and geodesic curvatures, Weingarten map, principal curvatures, Gaussian and mean curvatures.
5• Introducing the concepts: Equations of Gauss and geodesics.
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Course Description:

The course introduces the fundamentals of differential geometry primarily by focusing on the theory of curves and surfaces in three space. The theory of curves studies global properties of curves such as the four vertex theorem. The theory of surfaces introduces the fundamental quadratic forms of a surface, intrinsic and extrinsic geometry of surfaces, and the Gauss-Bonnet theorem.

Course Contents:

Unit I

Theory of Space Curves: Space curves, Planer curves, Curvature, torsion and Serret-Frenet formulae. Osculating circles, Osculating circles and spheres. Existence of space curves. Evolutes and involutes of curves.

Unit II

Theory of Surfaces:Parametric curves on surfaces. Direction coefficients.First and secondFundamental forms.Principal and Gaussian curvatures.Lines of curvature, Euler's theorem.Rodrigue'sformula, Conjugateand Asymptoticlines.

Developables:Developableassociatedwithspacecurvesandcurvesonsurfaces,Minimalsurfaces.

Unit III

Geodesics:Canonicalgeodesicequations.Natureofgeodesicsonasurfaceofrevolution.Clairaut's theorem.Normal property of geodesics.Torsion of a geodesic.Geodesic curvature.Gauss-Bonnet theorem.Surfaces of constant curvature.Conformal mapping.Geodesic mapping.Tissot'stheorem.

Unit IV

Tensors: Summation convention and indicial notation, Coordinate transformation and Jacobian,Contra-variantandCovariantvectors,Tensorsofdifferenttype,Algebraoftensorsandcontraction, Metric tensor and3-indexChristoffel symbols, Parallelpropagation ofvectors,Covariant and intrinsic derivatives, Curvature tensor and its properties, Curl, Divergence and Laplacianoperators in tensor form, Physical components.

Course Learning Outcomes (CLOs) :

Text books:

1. T.J.Willmore,*AnIntroduction to DifferentialGeometry*, DoverPublications,2012.
2. B.O'Neill,*Elementary DifferentialGeometry*, 2ndEd., Academic Press,2006.
3. C.E. Weatherburn, *Differential Geometry of Three Dimensions*, Cambridge University Press2003.

Reference books:

1. D.J.Struik,*Lectureson ClassicalDifferential Geometry*,Dover Publications,1988.
2. S. Lang,*FundamentalsofDifferentialGeometry*, Springer,1999.
3. B.Spain,*Tensor Calculus: A Concise Course*, Dover Publications,2003.

Online links for study & reference materials :

https://nptel.ac.in/courses/111/104/111104095/

Assessment method :(Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

Course Structure Template

L	T	P
2	0	0

Course Code: STUGM – SEC 11 **Course Name: Logic** and Sets
Course Credit Hour: 2hr **Total Contact Hour:** 35hr

Course Objective:

Mathematical logic is the framework upon which rigorous proofs are built. It is the study of the principles and criteria of valid inference and demonstrations. Logicians have analyzed set theory in great details, formulating a collection of axioms that affords a broad enough and strong enough foundation to mathematical reasoning

Course Description:

This course includes propositions, truth table, negation, conjunction and disjunction, Set operations and the laws of set theory and Venn diagrams, Relations with example of congruence modulo relation, Partial ordering relations.

Course Contents :

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

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

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

Course Learning Outcomes(CLOs) :

CLO-1 : Understand the different types of propositions.
CLO-2 : Learn the concept of Set operations and the laws of set theory and Venn diagrams.
CLO-3 :Understand Relation, Product set, Composition of relations, Types of relations

Text books :

R.P. Grimaldi, Discrete Mathematics and Combinatorial Mathematics, Pearson Education, 1998.

Reference books :

P.R. Halmos, Naive Set Theory, Springer, 1974.
E. Kamke, Theory of Sets, Dover Publishers, 1950

Online links for study & reference materials :

https://youtu.be/-lOgJki_h0E

Assessment method :(Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-4	- 05%
Assessment-5	- 05%
Total Internal Assessment	**- 40%**

Course Structure Template

L	T	P
2	0	0

Course Code: STUGM – SEC 12 **Course Name: Computer** Graphics
Course Credit Hour: 2hr **Total Contact Hour:** 35hr

Course Objective:

Computer Graphics can be a tools for increasing the awareness in the sciences subjects such as Mathematics among students. Because of the application of the real time, interactive, and visual feedback, students can easily observe the effects of the use of Mathematics in produce a good designs.

Course Description:

This course includes Development of computer Graphics,Scan conversion, line-drawing algorithms, linear transformations, line and polygon clipping algorithms.

Course Contents :

Unit I - Development of computer Graphics: Raster Scan and Random Scan graphics storages, displays processors and character generators, colour display techniques, interactive input/output devices. Points, lines and curves.

Unit II- Scan conversion, line-drawing algorithms, circle and ellipse generation, conic-section generation, polygon filling anti aliasing.

Unit III -Two-dimensional viewing: Coordinate systems, linear transformations, line and polygon clipping algorithms.

Course Learning Outcomes(CLOs) :

CLO-1 : Understand the different colour display techniques.
CLO-2 : Learn the concept of circle and ellipse generation.
CLO-3 : Understand line and polygon clipping algorithms.

Text books :

D. Hearn and M.P. Baker, Computer Graphics, 2nd Ed., Prentice–Hall of India,2004.

Reference books :

J.D. Foley, A van Dam, S.K. Feiner and J.F. Hughes, Computer Graphics: Principals and Practices, 2nd Ed., Addison-Wesley, MA, 1990.

D.F. Rogers, Procedural Elements in Computer Graphics, 2nd Ed., McGraw Hill Book Company, 2001.

Online links for study & reference materials :

https://youtu.be/W5P8GlaEOSI

Assessment method :(Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-4	- 05%
Assessment-5	- 05%
Total Internal Assessment	**- 40%**

Course Structure Template

L	T	P
2	0	0

Course Code: STUGM – SEC 21 **Course Name: Graph** Theory
Course Credit Hour: 2hr **Total Contact Hour:** 35hr

Course Objective:

To understand and apply the fundamental concepts in graph theory.
To understand the Graph theory based tools in solving practical problems and to improve the proof writing skills

Course Description:

This course includes and basic properties and types of graphs, travelling salesman's problem, shortest path,Dijkstra's algorithm and Floyd-Warshall algorithm.

Course Contents:

Unit I - Definition, examples and basic properties of graphs, pseudo graphs, complete graphs, bi-partite graphs, isomorphism of graphs, paths and circuits,

Unit II- Eulerian circuits, Hamiltonian cycles, the adjacency matrix, weighted graph, travelling salesman's problem, shortest path,

Unit III -Dijkstra's algorithm, Floyd-Warshall algorithm.

Course Learning Outcomes (CLOs) :

CLO-1 : Understand the basic types of the graphs.

CLO-2 :Learn the concept of travelling salesman's problem and find its shortest path.

CLO-3 : Understand Dijkstra's algorithm, Floyd-Warshall algorithm.

Text books :

Rudolf Lidl and Gunter Pilz, Applied Abstract Algebra, 2nd Ed., Undergraduate Texts in Mathematics, Springer (SIE), Indian reprint, 2004.

Reference books :

B.A. Davey and H.A. Priestley, Introduction to Lattices and Order, Cambridge University Press, Cambridge, 1990.

Edgar G. Goodaire and Michael M. Parmenter, Discrete Mathematics with Graph Theory, 2nd Edition, Pearson Education (Singapore) P. Ltd., Indian Reprint 2003.

Online links for study & reference materials :

https://youtu.be/XB4MIexjvY0

Assessment method :(Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-4	- 05%
Assessment-5	- 05%
Total Internal Assessment	**- 40%**

Course Structure Template

L	T	P
2	0	0

Course Code: STUGM – SEC 22 **Course Name: Operating** System: Linux
Course Credit Hour: 2hr **Total Contact Hour:** 35hr

Course Objective:

Linux is an open source operating system (OS). An operating system is the software that directly manages a system's hardware and resources, like CPU, memory, and storage. The OS sits between applications and hardware and makes the connections between all of your software and the physical resources that do the work.

Course Description:

This course includes The Operating System: Linux, history, features and Resource Management.

Course Contents:

Unit I - Linux – The Operating System: Linux history, Linux features, Linux distributions, Linux's relationship to Unix, Overview of Linux architecture, Installation, Startup scripts, system processes (an overview), Linux Security, The Ext2 and Ext3 File systems: General Characteristics of, The Ext3 File system, file permissions. User Management: Types of users, the powers of Root, managing users (adding and deleting): using the command line and GUI tools.

Unit II- Resource Management in Linux: file and directory management, system calls for files Process Management, Signals, IPC: Pipes, FIFOs, System V IPC, Message Queues, system calls for processes, Memory Management, library and system calls for memory.

Course Learning Outcomes(CLOs) :

CLO-1 : Understand the concept of operating system Linux.

CLO-2 : Learn the Resource Management in Linux.

Text books :

Sumitabha Das, Unix Concepts and Applications, 4th Ed., TMH, 2009.

Reference books :

1. Arnold Robbins, Linux Programming by Examples The Fundamentals, 2nd Ed., Pearson Education, 2008.
2. Cox K, Red Hat Linux Administrator's Guide, PHI, 2009.
3. R. Stevens, UNIX Network Programming, 3rd Ed., PHI, 2008.

Online links for study & reference materials:

https://youtu.be/yXLlF6uYynQ

Assessment method :(Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-4	- 05%
Assessment-5	- 05%
Total Internal Assessment	**- 40%**

.

Course Structure Template

L	T	P
4	0	2

Course Code: STUGM – GE 11 **Course Name: Fundamental of Computer Application**
Course Credit Hour: 2hr **Total Contact Hour:** 35hr

Course Objective:

Object-oriented programming aims to implement real-world entities like inheritance, hiding, polymorphism in programming. The main aim of OOP is to bind together the data and the functions that operate on them so that no other part of the code can access this data except that function.

Course Description:

This course includes Structure of a C++ program, data abstraction and Implementing Class Functions within Class declaration

Course Contents:

Unit I - OOP Paradigm: Comparison of Programming paradigms, Characteristics of Object-Oriented Programming Languages, Object-based programming languages C++: Brief History of C++,Structure of a C++ program, Difference between C and C++ - cin, cout, new, delete operators, ANSI/ISO Standard C++, Comments, Working with Variables and const Qualifiers. Enumeration, Arrays and Pointer.

Unit II- Implementing oops concepts in C++ Objects, Classes, Encapsulation, Data Abstraction, Inheritance, Polymorphism, Dynamic Binding, Message Passing, Default Parameter Value,Using Reference variables with Functions.

Unit III - Abstract data types, Class Component, Object & Class, Constructors Default and Copy Constructor, Assignment operator deep and shallow coping, Access modifiers – private, publicand protected. Implementing Class Functions within Class declaration or outside the Class declaration. instantiation of objects, Scope resolution operator, Working with Friend Functions, Using Static Class members. Understanding Compile Time Polymorphism function overloading Rules of Operator Overloading (Unary and Binary) as member function/friend function, Implementation of operator overloading of Arithmetic Operators, Overloading Output/Input,Prefix/ Postfix Increment and decrement Operators, Overloading comparison operators, Assignment, subscript and function call Operator , concepts of namespaces.

Course Learning Outcomes (CLOs) :

CLO-1 : Understand the difference between C and C++.
CLO-2 : Learn the different concepts in C++ Objects like Classes, Inheritance, Polymorphism
CLO-3 : Implementing Class Functions within Class declaration or outside the Class declaration

Text books:

1 R. Venugopal, Rajkumar, and T. Ravishanker, Mastering C++, TMH, 1997

Reference books :

S. B. Lippman and J. Lajoie, C++ Primer, 3rd Ed., Addison Wesley, 2000.
Bruce Eckel, Thinking in C++, 2nd Ed., President, Mindview Inc., Prentice Hall.
D. Parasons, Object Oriented Programming with C++, BPB Publication.
Bjarne Stroustrup , The C++ Programming Language, 3rd Ed., Addison Welsley

Online links for study & reference materials :

https://youtu.be/h4kUiFOb_v0

Assessment method :(Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-4	- 05%
Assessment-5	- 05%
Total Internal Assessment	**- 40%**

Course Structure Template

L	T	P
5	1	0

Course Code: STUGM – GE 12 **Course Name: Finite** Element Methods
Course Credit Hour: 2hr **Total Contact Hour:** 35hr

Course Objective:

To learn basic principles of finite element analysis procedure. To learn and apply finite element solutions to structural, thermal, dynamic problem to develop the knowledge and skills needed to effectively evaluate finite element analyses.

Course Description:

This course includes **-** Introduction to finite element methods,Applications to solving simple problems of ordinary differential equations and Simplex elements in two and three dimensions.

Course Contents:

Unit I - Introduction to finite element methods, comparison with finite difference methods, Methods of weighted residuals, collocations, least squares and Galerkin's method.Variational formulation of boundary value problems equivalence of Galerkin and Ritz methods.

Unit II- Applications to solving simple problems of ordinary differential equations. Linear, quadratic and higher order elements in one dimensional and assembly, solution of assembled system.

Unit III - Simplex elements in two and three dimensions, quadratic triangular elements, rectangular elements, serendipity elements and isoperimetric elements and their assembly, discretization with curved boundaries, Interpolation functions, numerical integration, and modeling considerations. Solution of two dimensional partial differential equations under different Geometric conditions.

Course Learning Outcomes (CLOs) :

CLO-1 :Understand the concepts behind formulation methods in Finite Element Methods (FEM)

CLO-2 :Develop element characteristic equation and generation of global equation.

CLO-3 :Able to apply Simplex elements in two and three dimensions

Text books:

J.N. Reddy, Introduction to the Finite Element Methods, Tata McGraw-Hill, 2003.

Reference books :

1. K.J. Bathe, Finite Element Procedures, Prentice-Hall, 2001.
2. R.D. Cook, D.S. Malkus and M.E. Plesha, Concepts and Applications of Finite Element Analysis, John Wiley and Sons, 2002.
3. Thomas J.R. Hughes, The Finite Element Method: Linear Static and Dynamic Finite Element Analysis, Dover Publication, 2000.

Online links for study & reference materials :

https://youtu.be/__4REhFXmp

Assessment method :(Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-4	- 05%
Assessment-5	- 05%
Total Internal Assessment	**- 40%**

Course Structure Template

L	T	P
5	1	0

Course Code: STUGM – GE 21 **Course Name: Mathematical** Finance
Course Credit Hour: 2hr **Total Contact Hour:** 35hr

Course Objective:

Mathematical finance is an interdisciplinary study of financial markets. It helps economist/trader to make decisions and frame policies to his/her advantage.

Course Description:

This course includes Basic principles: Comparison, arbitrage and risk aversion, Interest, Asset return, short selling, portfolio return.

Course Contents:

Unit I - Basic principles: Comparison, arbitrage and risk aversion, Interest (simple and compound, discrete and continuous), time value of money, inflation, net present value, internal rate of return (calculation by bisection and Newton-Raphson methods), comparison of NPV and IRR. Bonds, bond prices and yields, Macaulay and modified duration, term structure of interest rates: spot and forward rates, explanations of term structure, running present value, floating-rate bonds, immunization, convexity, putable and callable bonds.

Unit II- Asset return, short selling, portfolio return, (brief introduction to expectation, variance, covariance and correlation), random returns, portfolio mean return and variance, diversification, portfolio diagram, feasible set, Markowitz model (review of Lagrange multipliers for 1 and 2 constraints), Two fund theorem, risk free assets, One fund theorem, capital market line, Sharpe index. Capital Asset Pricing Model (CAPM), betas of stocks and portfolios, security market line, use of CAPM in investment analysis and as a pricing formula, Jensen's index.

Course Learning Outcomes (CLOs) :

CLO-1: Understand the Basic principles of Finance
CLO-2: Learn different types of model like Markowitz mode etc.

Text books:

1. David G. Luenberger, Investment Science, Oxford University Press, Delhi, 1998.
2. John C. Hull, Options, Futures and Other Derivatives, 6th Ed., Prentice-Hall India, Indian reprint, 2006.

Reference books :

1. Sheldon Ross, An Elementary Introduction to Mathematical Finance, 2nd Ed., Cambridge University Press, USA, 2003.

Online links for study & reference materials :

https://youtu.be/bkqyRseAbWY

Assessment method :(Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-4	- 05%
Assessment-5	- 05%
Total Internal Assessment	**- 40%**

Course Structure Template

L	T	P
5	1	0

Course Code: STUGM – GE 22 **Course Name: Econometrics**
Course Credit Hour: 6hr **Total Contact Hour:** 90hr

Course Objective:

Econometrics deals with the measurement of economic relationships.There is a need of finding the stochastic relationship in mathematical format, the econometric methods and tools help. The econometric tools are helpful in explaining the relationships among variables.

Course Description:

This course includes Statistical Concepts and different types of the distribution, simple linear regression model, multiple regression model and Detection and Remedies Multicollinearity, heteroscedasticity.

Course Contents:

Unit I - Statistical Concepts Normal distribution; chi-square, t and F-distributions; estimation of parameters; properties of estimators; testing of hypotheses: defining statistical hypotheses; distributions of test statistics; testing hypotheses related to population parameters; Type I and Type II errors; power of a test; tests for comparing parameters from two samples.

Unit II- Simple Linear Regression Model: Two Variable Case Estimation of model by method of ordinary least squares; properties of estimators; goodness of fit; tests of hypotheses; scaling and units of measurement; confidence intervals; Gauss-Markov theorem; forecasting.

Unit III -Multiple Linear Regression Model Estimation of parameters; properties of OLS estimators; goodness of fit - R2 and adjusted R2 ; partial regression coefficients; testing hypotheses – individual and joint; functional forms of regression models; qualitative (dummy) independent variables.

Unit IV-Violations of Classical Assumptions: Consequences, Detection and Remedies Multicollinearity; heteroscedasticity; serial correlation. Specification Analysis Omission of a relevant variable; inclusion of irrelevant variable; tests of specification errors.

Course Learning Outcomes(CLOs) :

CLO-1**:** Learn Statistical Concepts and different types of distribution.
CLO-2:Understand the Simple Linear Regression Model
CLO-3 : Learn Multiple Linear Regression Model and Estimation of parameters.
CLO-4 : Understand Multicollinearity and heteroscedasticity

Text books :

1. Christopher Dougherty, Introduction to Econometrics, Oxford University Press, 3rd Ed., Indian edition, 2007.

Reference books :

1. Jay L. Devore, Probability and Statistics for Engineers, Cengage Learning, 2010.
2. John E. Freund, Mathematical Statistics, Prentice Hall, 1992.
3. Richard J. Larsen and Morris L. Marx, An Introduction to Mathematical Statistics and its Applications, Prentice Hall, 2011.

Online links for study & reference materials :

https://youtu.be/dQNpSa-bq4M

Assessment method :(Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-4	- 05%
Assessment-5	- 05%
Total Internal Assessment	**- 40%**

Course Structure Template

L	T	P
2	0	0

Course Code: STUGM – GE 41 **Course Name: Applications** of Algebra
Course Credit Hour: 2hr **Total Contact Hour:** 35hr

Course Objective:

The main Objective of Algebra is to develop fluency in working with linear equations. Students will extend their experiences with tables, graphs, and equations and solve linear equations and inequalities and systems of linear equations and inequalities.

Course Description:

This course includes Balanced incomplete block designs (BIBD), Special types of matrices And Applications of linear transformations.

Course Contents:

Unit I - Balanced incomplete block designs (BIBD): definitions and results, incidence matrix of a BIBD, construction of BIBD from difference sets, construction of BIBD using quadratic residues, difference set families, construction of BIBD from finite fields.

Unit II- Special types of matrices: idempotent, nilpotent, involution, and projection tri diagonal matrices, circulant matrices, Vandermonde matrices, Hadamard matrices, permutation and doubly stochastic matrices, Frobenius- König theorem, Birkhoff theorem. Positive Semi-definite matrices: positive semi-definite matrices, square root of apositive semi-definite matrix, a pair of positive semi-definite matrices, and their simultaneous diagonalization. Symmetric matrices and quadratic forms: diagonalization of symmetric matrices, quadratic forms, constrained optimization, singular value decomposition, and applications to image processing and statistics.

Unit III -Applications of linear transformations: Fibonacci numbers, incidence models, and differential equations. Least squares methods: Approximate solutions of system of linear equations, approximate inverse of an m×n matrix, solving a matrix equation using its normal equation, finding functions that approximate data. Linear algorithms: LDU factorization, the row reduction algorithm and its inverse, backward and forward substitution, approximate inverse and projection algorithms.

Course Learning Outcomes(CLOs) :

CLO-1**:** Understand the Balanced incomplete block designs (BIBD).
CLO-2: Learn the Special types of matrices
CLO-3 : Understand Applications of linear transformations

Text books :

1. David C. Lay, Linear Algebra and its Applications. 3rd Ed., Pearson Education Asia, Indian Reprint, 2007.

Reference books :

1. I. N. Herstein and D. J. Winter, Primer on Linear Algebra, Macmillan Publishing Company, New York, 1990.
2. S. R. Nagpaul and S. K. Jain, Topics in Applied Abstract Algebra, Thomson Brooks and Cole, Belmont, 2005.

Online links for study & reference materials :

https://youtu.be/y9ame4BGEvE

Assessment method :(Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-4	- 05%
Assessment-5	- 05%
Total Internal Assessment	**- 40%**

Course Structure Template

L	T	P
2	0	0

Course Code : STUGM – GE 42 **Course Name :**Combinatorial Mathematics
Course Credit Hour : 2hr **Total Contact Hour :** 35hr

Course Objective :

Combinatorial Mathematics, is the field of mathematics concerned with problems of selection, arrangement, and operation within a finite or discrete system. Its objective is: How to count without counting. Therefore, One of the basic problems of combinatorics is to determine the number of possible configurations of objects of a given type.

Course Description :

This course includes Basic counting principles, Permutations and Combinations, Generating functions, Integer partitions, Polya theory of counting: Necklace problem and Burnside's lemma.

Course Contents :

Unit I - Basic counting principles, Permutations and Combinations (with and without repetitions), Binomial theorem, Multinomial theorem, Counting subsets, Set-partitions, Stirling numbers Principle of Inclusion and Exclusion, Derangements, Inversion formulae.

Unit II- Generating functions: Algebra of formal power series, Generating function models, Calculating generating functions, Exponential generating functions. Recurrence relations: Recurrence relation models, Divide and conquer relations, Solution of recurrence relations, Solutions by generating functions.

Unit III -Integer partitions, Systems of distinct representatives. Polya theory of counting: Necklace problem and Burnside's lemma, Cyclic index of a permutation group, Polya's theorems and their immediate applications. Latin squares, Hadamard matrices, Combinatorial designs: t designs, BIBDs, Symmetric designs.

Course Learning Outcomes(CLOs) :

CLO-1**:** Understand theBasic counting principles, Permutations and Combinations
CLO-2: Learn about the Generating functions.
CLO-3 : Understand Polya theory of counting: Necklace problem and Burnside's lemma.

Text books :

1. S.S. Sane, Combinatorial Techniques, Hindustan Book Agency, 2013.
2. V. Krishnamurthy, Combinatorics, Theory and Application, Affiliated East-West Press1985.

Reference books :

1. P.J. Cameron, Combinatorics, Topics, Techniques, Algorithms, Cambridge University Press, 1995.
2. M. Jr. Hall, Combinatorial Theory, 2nd Ed., John Wiley & Sons, 1986.

Online links for study & reference materials :

https://youtu.be/qnVM27nKH4Q
https://youtu.be/WLPqom-EcMw

Assessment method :(Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-4	- 05%
Assessment-5	- 05%
Total Internal Assessment	**- 40%**

Course Structure Template

L	T	P
5	1	0

Course Code: STUGM – GE **Course Name: Introduction** to Operating System
Course Credit Hour: 6hr **Total Contact Hour: 72hr**

Course Objective:

The objective of Introduction to operating system to learn about design principles of operating systems and To do a case study of Operating System

Course Description:

This course includes Basic counting principles, Permutations and Combinations, Generating functions, Integer partitions, Polya theory of counting: Necklace problem and Burnside's lemma.

Course Contents:

Unit I –
Fundamentals of Operating system: Introduction to Operating System, its need and Operating System services, Early systems, Structures - Simple Batch, Multi programmed, timeshared, Personal Computer, Parallel, Distributed Systems, Real-Time Systems. Process Management: Process concept, Operation on processes, Cooperating Processes, Threads, and Inter-process Communication..

Unit II –
CPU Scheduling: Basic concepts, Scheduling criteria, Scheduling algorithms : FCFS, SJF,Round Robin & Queue Algorithms. Deadlocks: Deadlock characterization, Methods for handling deadlocks, Banker's Algorithm.

Unit III -
Memory Management: Logical versus Physical address space, Swapping, Contiguousallocation, Paging, Segmentation. Virtual Memory: Demand paging, Performance of demand paging, Page replacement, Page replacement algorithms, Thrashing

Unit-IV-
File management: File system Structure, Allocation methods: Contiguous allocation, Linked allocation, Indexed allocation, Free space management: Bit vector, Linked list, Grouping, Counting.

Unit-V-
Device Management: Disk structure, Disk scheduling: FCFS, SSTF, SCAN, C-SCAN, LOOK, C-LOOK.

Course Learning Outcomes(CLOs) :

CLO-1**:** Analyze the structure of OS and basic architectural components involved in OS design.
CLO-2: Analyze and design the applications to run in parallel either using process or thread models of different OS
CLO-3 : Demonstrate the various device and resource management techniques for timesharing and distributed systems.
CLO-4 : Understand the Mutual exclusion, Deadlock detection and agreement protocols of Distributed operating system
CLO-5**:** Interpret the mechanisms adopted for file sharing in distributed.

Text books :

1. EktaWalia, "Operating Systems Concepts", Khanna Publishes, New Delhi, 2002.

Reference books :

1. Abraham Silberschatz, Peter B. Galvin, " Operating System Concepts", Addison-Wesley publishing. Co., 7th. Ed., 2004.
2. Nutt Gary, "Operating Systems", Addison Wesley Publication, 2000.
3. Andrew S. Tannenbaum, "Modern Operating Systems", Pearson Education Asia, Second Edition, 2001.
4. William Stallings, "Operating Systems, "Internals and Design Principles", 4th Edition, PH, 2001.

Online links for study & reference materials :

https://youtu.be/RozoeWzT7IM

Assessment method :(Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-4	- 05%
Assessment-5	- 05%
Total Internal Assessment	**- 40%**

Course Structure Template

L	T	P
2	0	0

Course Code: STUGM – AECC 01 **Course Name: ENVIRONMENTAL** SCIENCES
Course Credit Hour: 2hr **Total Contact Hour:** 35hr

Course Objective:

Creating the awareness about environmental problems among people.Imparting basic knowledge about the environment and its allied problems.Developing an attitude of concern for the environment. Motivating public to participate in environment protection and environment improvement

Course Description:

This course includes Natural Resources, Ecosystems, Biodiversity and its conservation, Environmental Pollution and Environmental Policies &amp.

Course Contents:

Unit I- : Natural Resources**:** Forest resources: Use and over-exploitation, deforestation, case studies. Timberextraction, mining, dams and their effects on forests and tribal people, (b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water,dams-benefits and problems. (c) Mineral resources: Use and exploitation, environmentaleffects of extracting and using mineral resources, case studies. (d) Food resources: Worldfood problems, changes caused by agriculture and overgrazing, effects of modernagriculture, fertilizer-pesticide problems, water logging salinity, case studies. (e) Energyresources: Growing energy needs, renewable and non- renewable energy sources, use ofalternate energy sources (f) Land resources: Land as a resource, landdegradation, man induced landslides, soil erosion and desertification. Role of an individualin conservation of natural resources. Equitable use of resources for sustainable lifestyles.

Unit II - Ecosystems**:** Concept of an ecosystem, Structure and function of an ecosystem, Producers, consumersand decomposers, Energy flow in the ecosystem, Ecological succession, Food chains, foodwebs and ecological pyramids, Introduction, types, characteristic features, structure andfunction of the following ecosystem :- (a) Forest ecosystem, (b) Grassland ecosystem, (c)Desert ecosystem, (d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Unit III - Biodiversity and its conservationIntroduction – Definition: genetic, species and ecosystem diversity, Biogeographicalclassification of India, Value of biodiversity : consumptive use, productive use, socialethical, aesthetic and option values, Biodiversity at global, National and local levels, Indiaas a mega diversity nation, Hot-spots of biodiversity, Threats to biodiversity : habitat loss,poaching of wildlife, man-wildlife conflicts, Endangered and endemic species of India,Conservation of biodiversity : In-situ and Ex situ conservation of biodiversity.

Unit IV -Environmental Pollution: Definition, Causes, effects and control measures of: (a) Air pollution, (b) Water pollution, (c) Soil pollution, (d) Marine pollution (e) Noise pollution, (f) Thermal pollution, (g) Nuclear hazards. Human health risks; Solid waste management: Control measures of urban and industrial waste. Pollution case studies.

Unit V -Environmental Policies & Practices: Sustainability and sustainable development; Climate change, global warming, ozone layer depletion, acid rain and impacts on human communities and agriculture; Environment Laws: Environment Protection Act; Air (Prevention & Control of Pollution) Act; Water (Prevention and control of Pollution) Act; Wildlife Protection Act; Forest Conservation Act.; Nature reserves, tribal populations and rights, and human wildlife conflicts in Indian context**.**

Course Learning Outcomes(CLOs) :

CLO-1**:** Understand the Natural Resources.
CLO-2: Learn about Ecosystems.
CLO-3 : Understand Biodiversity and its conservation.
CLO-4 : Learn about the Environmental Pollution.
CLO-5 : Understand Environmental Policies & Practices

Text books :

1. Bharucha, E. 2003, Textbook for Environmental Studies, University Grants Commission, New Delhi and BharatiVidyapeeth Institute of Environmental Education and Research, Pune. 361.

Reference books :

1. Odum, E.P., Odum, H.T. & Andrews, J. 1971. Fundamentals of Ecology. Philadelphia: Saunders.
2. Pepper, I.L., Gerba, C.P. & Brusseau, M.L. 2011. Environmental and Pollution Science. Academic press, 2011.

Online links for study & reference materials :

https://youtu.be/_mgvsPnCYj4

Assessment method :(Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-4	- 05%
Assessment-5	- 05%
Total Internal Assessment	**- 40%**