

**DIT UNIVERSITY  
Dehradun**



**Detailed Course Structure & Syllabus  
of  
B.Sc. (Mathematics) Honours/Honours with Research  
(4 Year Program with Minor)**

# Course Structure & Syllabus of B.Sc. (Mathematics) 4 Year Program

## Applicable for Batch: 2023-27

### Introduction

The Ministry of Human Resource Development (MHRD), Govt. of India, has initiated development of a New Education Policy (NEP) to bring out comprehensive reforms in the Indian education system.

The University Grants Commission (UGC) has subsequently initiated several steps to foster academic excellence through introduction of paradigm shift in learning and teaching pedagogy, innovation and improvement in course curricula, examination and education system.

While a majority of education institutions have started following the semester-based system of education, it has been observed that this new system is still producing graduates who lack knowledge, values, skills and are not job ready professional. The reason for this lacking could be attributed to the rigidity of our program structures and lack of flexibility to have choices among core subject education, liberal arts, ability enhancement, skill development, etc., that is fundamental to overall development and employability of these graduates.

In accordance with the NEP 2020, the UGC has formulated a new student-centric “Curriculum and Credit Framework for Undergraduate Programmes (CCFUP)” incorporating a flexible choice-based credit system, multidisciplinary approach, and multiple entry and exit options. Further, it also recommends that the undergraduate degree will be of either 3 or 4-year duration, with multiple exit options within this period, with appropriate certifications, e.g., a UG certificate after completing 1 year in a discipline or field including vocational and professional areas, or a UG diploma after 2 years of study, or a Bachelor’s degree after a 3-year programme. The 4-year multidisciplinary Bachelor’s programme, however, shall be the preferred option since it allows the opportunity to experience the full range of holistic and multidisciplinary education in addition to a focus on the chosen major and minors as per the choices of the student.

### Advantages of CCFUP

- Shift in focus from the teacher-centric to student-centric education. Student can curve out their program structure by choosing minimum number of credits from well-defined baskets.
- Student may undertake as many credits as they can cope with.
- CCFUP allows students to obtain 4 year Honors degree with Minor in a discipline of their interest by choosing courses offered by other departments, from various baskets of inter-disciplinary, intra-disciplinary, skill oriented, ability enhancing, and from other disciplines.

### Features unique to DIT University CCFUP structure:

1. A minimum of 120 credits has to be earned by a student to be eligible for a 3 year Under Graduate degree in Sciences and a minimum of 160 credits for a 4-year Undergraduate Degree (Honors) OR (Honors in Research). Each department will decide their total credits for each program, and it can vary across disciplines.
2. Courses are categorized into 8 baskets, and a student will have the option to choose courses in most baskets and earn *minimum number of credits* required in each basket for the award of his/her degree. For each basket, the departments have the flexibility to identify course(s) which will be a core requirement for their program.
3. An Academic Advisory Committee may be formed comprising all HoDs/ Programme Coordinator and one representative each from respective departments. Academic Advisory Committee will meet at the end of every semester after the completion of Board of Examination meeting to discuss and finalize course offerings by respective departments in the upcoming

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semester. Academic Advisory Committee will be chaired by the Dean Academic Affairs/ Deans of respective Schools/ Competent Authority.

4. To provide sufficient flexibility and room during the program for additional *Internships, Project, Vocational Studies*, 8-week summer semesters (Summer 1, Summer 2, and Summer 3) may have to run. Summer semesters are critical for implementing a fully flexible system. Each department will decide *a priori* which courses to offer in the summer semester and get them finalized at the Academic Advisory Committee meeting.
5. Project based learning has to be incorporated as a core component of evaluation in each course, and depending on the level and type of the course, the project can be of several types - Study Oriented Project, Lab Oriented Project, Design Oriented Project, Computer Oriented Project, Projects of Organizational Aspects, Research Projects, or Entrepreneurship and Start Up Projects.
6. Courses under each basket may be updated on an annual basis.
7. Each student will be advised by a faculty advisor of his/her department for registration of courses from each basket in the beginning of semester, depending upon the availability of seats. A student advising center may be formed where students will have access to department faculty advisers. Faculty advisers should have complete access to view individual student's academic transcript for advising purposes.
8. A student getting an F grade in a core course (departmental or otherwise) at the end of the semester will have to earn those credits by registering for the same course whenever it is offered in subsequent semesters. If the course is not a core course, the student may choose to register for any other course next semester in that basket as advised by the department faculty adviser. Additional fees for those number of credits may apply.
9. Students may opt for summer training/internships/industrial tours as advised by the department. However, these activities will not have credits.

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### Baskets of CCFUP

8 baskets of courses have been identified to provide student comprehensive exposure to a large number of areas, leading to the holistic development of an individual. These baskets are as follows:

S. No.	Basket	Details
1	Major (Core)	In-depth study of a particular subject or discipline
2	Minor	Different interdisciplinary minors After securing the specified credits in minor, student is eligible for a degree in major discipline with minor in the chosen interdisciplinary course
3	Multidisciplinary	Natural and Physical Sciences: Chemistry, Physics, Biophysics, Astronomy and Astrophysics, Earth and Environmental Science etc. Mathematics, Statistics, and Computer Applications: Python, data analysis software, etc. Library, information, and media science: journalism, mass media, and communication Commerce and Management: Business Management, accountancy, finance. Humanities and Social Sciences: Economics, History, Linguistics, Psychology, sustainable development etc.
4	Ability enhancement courses (AEC)	Modern Indian language and English language focused on language and communication skills
5	Skill enhancement courses (SEC)	Courses on Hands on training, soft skills, institutes may design their own courses also
6	Value added courses common for all UG	Understanding India Environmental Science, Digital and technological solutions: AI, 3D machining, big data, machine learning etc. Health and Wellness, Yoga, sports and fitness
7	Summer Internship	Field based learning/minor project
8	Research Project/Dissertation	Students for 4 year degree (Honors with Research) to take up research project under guidance of faculty member

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**Structure of the B.Sc. (Mathematics) Program**

S.No.	Basket	Minimum credit requirement			Credit per Course	Total Courses		
		3 year UG	4 year UG (Honours)	4 year UG (Honours with Research)		3 year UG	4 year UG (Honours)	4 year UG (Honours with Research)
1	Major (Core)	60	88	76	4	15	22	19
2	Minor	24	32	32	4	6	8	8
3	Inter-disciplinary	16	16	16	2-5	4	4	4
4	Ability enhancement courses (AEC)	9	9	9	3	3	3	3
5	Skill enhancement courses (SEC)	9	9	9	3	3	3	3
6	Value added courses common for all UG	6	6	6	2	3	3	3
7	Summer Internship		2	2			1	1
8	Research Project/Dissertation			12	12			1
	<b>Total</b>	<b>124</b>	<b>162</b>	<b>162</b>		<b>34</b>	<b>44</b>	<b>42</b>

# Course Structure & Syllabus of B.Sc. (Mathematics) 4 Year Program

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## B.Sc. (Hons. / Hons. With Research) Mathematics

Semester	Discipline Courses (80)	Minor Courses (32)	Inter-disciplinary Courses (9)	Ability Enhancement (Language) Courses (8)	Skill Enhancement /Internship/Dissertation (9)	Common Value-Added Courses (6-8)	Total Credits
I	Calculus-I (4)	Minor in CS	Can be clubbed with Minor	Prof Comm (Language) (3)	Aptitude and skill Enhancement-I (3)	Indian Constitution (2)	21
		CS-1 (4)	Mechanics (5)				
II	Calculus -II (4)	Minor in ECO	Can be clubbed with Minor	Corporate communications and soft skills (3)	Introduction to MATLAB (3)	Environmental Science (2)	21
		ECO-1 (4)	Chemistry-I Physical Chemistry-I (5)				
<b>Total Credits</b>	<b>8</b>	<b>8</b>	<b>10</b>	<b>6</b>	<b>6</b>	<b>4</b>	<b>42</b>
UG certificate: Student can exit the program after securing 40 credits with additional 4 credits in work based vocational course or summer internship during summer term							
III	Linear Algebra (4)  Ordinary Differential Equations (4)	Minor in CS / Phy /Che /ECO (Choose One)	Choose any One	Human Values and Ethics (3)	Technical Writing with LATEX (3)	Yoga/Physical Education (2)	22
			Introduction to Python (2)  Introduction to Mathematica (2)				
IV	Solid Geometry (4)	Minor in CS / Phy /Che /ECO(Choose One)					20

Approved by the Academic Council at its 22nd meeting held on 06.03.2023

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	Computer Based Numerical Techniques (4)						
	Real Analysis- I (4)						
	Partial Differential Equations (4)						
<b>Total Credits</b>	<b>32</b>	<b>16</b>	<b>12</b>	<b>9</b>	<b>9</b>	<b>6</b>	<b>84</b>
<b>UG diploma: Student can exit the programme after securing minimum 80 credits with additional 4 credits in work based vocational course or summer internship during summer term.</b>							
V	Real Analysis- II (4) Complex Analysis (4) Integral Transforms (4) Linear Programming (4)	Minor in CS / Phy /Che /ECO (Choose One)					20
VI	Abstract Algebra (4)* Graph Theory (4)* <b>Choose any one</b> Tensors & Differential Geometry (4) Special Functions (4)	Minor in CS / Phy /Che /ECO (Choose two)					20
<b>Total Credits</b>	<b>60</b>	<b>28</b>	<b>12</b>	<b>9</b>	<b>9</b>	<b>6</b>	<b>124</b>
<b>3-year UG Degree: Student can exit the programme after securing minimum 120 credits</b>							

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VII	Fields and Galois theory (4) Topology (4) Integral Equations (4) Mathematical Modelling (4)	<b>Minor in CS / Phy /Che /ECO (Choose One)</b>					20
	Fuzzy sets and Artificial Intelligence (4)  <b>Numerical Partial Differential Equation(4)</b> Functional Analysis (4) OR Research Project/Dissertation (12) Seminar for both Streams (2)	<b>Minor in CS / Phy /Che /ECO (Choose One)</b>					18
<b>Total Credits</b>	<b>88+2</b>	<b>36</b>	<b>12</b>	<b>9</b>	<b>9</b>	<b>6</b>	<b>162</b>

## Course Structure & Syllabus of B.Sc. (Mathematics) 4 Year Program Applicable for Batch: 2023-27

For B.Sc. (Mathematics) with Minor in other Discipline
Discipline Courses (60 credits for 3 year UG, 88 credits for 4 year UG)

S.No.	Name of Courses	L	T	P	C
1	Calculus-I	3	1	0	4
2	Calculus -II	3	1	0	4
3	Linear Algebra	3	1	0	4
4	Ordinary Differential Equations	3	1	0	4
5	Solid Geometry	3	1	0	4
6	Computer Based Numerical Techniques	3	0	2	4
7	Real Analysis- I	3	1	0	4
8	Partial Differential Equations	3	1	0	4
9	Real Analysis- II	3	1	0	4
10	Complex Analysis	3	1	0	4
11	Integral Transforms	3	1	0	4
12	Linear Programming	3	1	0	4
13	Abstract Algebra	3	1	0	4
14	Graph Theory	3	1	0	4
15	Tensors & Differential Geometry	3	1	0	4
16	Special Functions	3	1	0	4
17	Fields and Galois theory	3	1	0	4
18	Topology	3	1	0	4
19	Integral Equations	3	1	0	4
20	Mathematical Modelling	3	1	0	4
21	Fuzzy sets and Artificial Intelligence	3	1	0	4
22	Numerical Partial Differential Equation	3	1	0	4
23	Functional Analysis	3	1	0	4

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Interdisciplinary Courses (16 credits)					
S.No.	Name of Courses	L	T	P	C
1	Mechanics	3	1	2	5
2	Physical Chemistry-I	3	1	2	5
3	Economics/Physics/Chemistry/CS				4
4	Introduction to Python <b>OR</b> Introduction to Mathematics	0	0	4	2

Ability Enhancement Courses (9 credits)					
S.No.	Name of Courses	L	T	P	C
1	Professional Communication	2	0	2	3
2	Human Values	3	0	0	3
3	Corporate Communication and Soft Skills	2	0	2	3
Skill Enhancement Courses (9 credits)					
S.No.	Name of Courses	L	T	P	C
1	Technical Writing with LATEX-I	2	0	2	3
2	Introduction to MATLAB	2	0	2	3
3	Aptitude and Skill Enhancement-I	3	0	0	3
Common Value-Added Courses (6 credits)					
S.No.	Name of Courses	L	T	P	C
1	Environmental Science	2	0	0	2
2	Indian Constitution	2	0	0	2
3	Yoga <b>OR</b> Physical Education	0	0	4	2
Project (12 credits)					
1	Research Project				12

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### Discipline Courses (Semester-I)

Department offering the course	Mathematics
Course Code	MAF108
Course Title	Calculus-I
Credits (L:T:P:C)	3:1:0:4
Contact Hours (L:T:P)	3:1:0
Prerequisites (if any)	None
Course Basket	Discipline Core

### Course Summary

#### Course Objectives

To prepare the students with basic concepts of limit, continuity, differentiability, and integration of functions and their applications.

#### Course Outcome

Students will be able to:

- find derivative and anti-derivative of various functions and use them for further study
- draw graph of various functions in Cartesian and Polar coordinates
- determine area, volume, surface of revolutions using definite integrals
- use the concepts of calculus in higher learning.

### Curriculum Content

#### UNIT I: Limit and Continuity [8]

Review of functions of single variable: Exponential, Logarithmic, Trigonometric and Hyperbolic functions, Limit, Continuity, Algebra of limits and continuous functions.

#### UNIT II: Differentiability [10]

Differentiability, Indeterminate forms, L' Hospital rule, Rolle's Theorem, Mean value theorems & their applications, Successive differentiation, Leibnitz theorem, Maclaurin & Taylor series of functions of one variable.

#### UNIT III: Applications of Derivatives [10]

Review conic sections and their Graphs, Monotonicity, Maxima and Minima, Concavity, Convexity, Point of inflection & Asymptotes, Polar coordinates, Curvature, Envelope of a family of curves, Graphs of functions and curves.

#### UNIT IV: Integral Calculus [12]

Review of indefinite and definite integrals, Fundamental theorem of integral calculus, Integral as the limit of sum, Area, Volume and surface of revolution, Arc lengths, Double and triple integrals, Change of order of integration, Change of variables, Beta and Gamma function, Dirichlet's integral, Application of multiple integrals.

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## **Applicable for Batch: 2023-27**

### **Text Books**

1. G. B. Thomas and R. L. Finney, “Calculus and Analytic Geometry”, 9<sup>th</sup> Edition, Pearson Education India, 2010

### **Reference Books**

1. R. K. Jain, & S. R. K. Iyenger, “Advanced Engineering Mathematics”, 4<sup>th</sup> Edition, Narosa Publishing House, New Delhi, India, 2014.
2. E. Kreyszig, “Advanced Engineering Mathematics”, 10<sup>th</sup> Edition, John & Wiley Sons, U.K., 2016.
3. Gorakh Prasad, “Integral Calculus”, Pothishala Private Limited, 2015

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### Discipline Courses (Semester-II)

Department offering the course	Mathematics
Course Code	MAF116
Course Title	Calculus-II
Credits (L:T:P:C)	3:1:0:4
Contact Hours (L:T:P)	3:1:0
Prerequisites (if any)	None
Course Basket	Discipline Core

### Course Summary

**Course Objective:** Exposure to concepts of Vector Calculus, Vector Geometry, Vector Integration, Line and Surface Integrals and their relations to double and triple integrals.

### Learning Outcome

After completion of this course student will be able to:

- know the concepts of limit, continuity and differentiability in two-dimensional plane.
- evaluate the partial derivatives, application of Euler's theorem and maxima and minima of two variables.
- analyze the vector calculus and its applications in two and three –dimensional geometry.
- calculate surface integral and volume integral.

### Curriculum Content

#### UNIT I: Functions of Several Variables [10]

Limit, Continuity and differentiability, Partial differentiation, Euler's theorem and applications, Total Differential, Jacobian and its application, Taylor series of functions of two variables, Extrema of functions of several variables, Lagrange's multiplier method.

#### UNIT II: Vector Differential Calculus [9]

Review of Vector Algebra in  $R^2$  &  $R^3$ , Inner (Dot) Product, Cross Product, Parametric representation of curves, Continuity, Differentiation and integration of vector functions, Tangent and arc-length, Curves in Mechanics (Velocity and Acceleration), Gradient of a scalar field, Directional Derivative, Normal to a curve, Divergence & Curl of vector function and their applications, Physical interpretation of Divergence and Curl.

#### UNIT III: Vector Integration [10]

Line integrals, Application of line integral, Determination of a scalar potential, Integration around closed curves, Conservative and Non-conservative physical systems, Line integrals independent of path, Green's Theorem, Application of Green's theorem,

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## **Applicable for Batch: 2023-27**

### **UNIT IV: Surface and Volume integral**

**[11]**

Review of double and triple integration, Parametric representations of surfaces (cylinder, sphere and cone), Tangent plane and surface normal, Surface area and Surface integrals, Gauss divergence theorem and applications, Evaluation of surface integrals by Gauss divergence theorem, Stokes theorem, Green's theorem in the plane as a special case of Stokes theorem,

#### **Text Books:**

1. E. Kreyszig, "Advanced Engineering Mathematics", 10<sup>th</sup> Edition, John & Wiley Sons, U.K., 2016.
2. MD. Ali Ashraf, and MD. Abdul Khaleq Hazra, "Vector Analysis with Application", 3<sup>rd</sup> Edition,
3. New Age International (P) Ltd, 2006.

#### **Reference Books:**

1. R. K. Jain, & S. R. K. Iyenger, "Advanced Engineering Mathematics", 4<sup>th</sup> Edition, Narosa Publishing House, New Delhi, India, 2014.
2. Seymour Lipschutz, Dennis Spellman, and Murray, Spiegel, "Vector Analysis", 2<sup>nd</sup> Edition,
3. McGraw Hill Education (India) Private Ltd., 20

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### Minor Courses (Semester-I)

### Inter-disciplinary Courses (Semester-I)

Department offering the course	Physics
Course Code	PYFN107
Course Title	Mechanics
Credits (L:T:P:C)	3:1:2:5
Contact Hours (L:T:P)	3:1:2
Prerequisites (if any)	None
Course Basket	Discipline Course

### COURSE SUMMARY

This course starts with the basic concepts of work, energy and collisions between particles. The course then covers the angular motion of bodies and moment of inertia, elasticity, fluid motion, laws of gravitation and special theory of relativity.

### COURSE OBJECTIVE

The aim of this course is to introduce students to both elementary classical mechanics and the basic ideas of Special Relativity

**Course Pre/Co- requisite (if any)** Basic knowledge of vectors

### COURSE OUTCOME

**On successful completion of the course, students will be able to achieve the following:**

1. To know Newton's laws of motion, potentials, conservation of energy, momentum and angular momentum, and be able to apply them to projectiles, circular motion, and gravity
2. Demonstrate rigid body and rotational dynamics using the concept of angular velocity and momentum.
3. Demonstrate an understanding of intermediate mechanic's topics such as co-ordinate transformations, oscillatory motion, gravitation etc.
4. Understand the concept of non-inertial frames of reference, Coriolis and centripetal accelerations and their applications
5. Understand the postulates of Special Relativity and their consequences in terms of Time dilation and length contraction, Lorentz transformations, relativistic kinematics and the relation between mass and energy

# **Course Structure & Syllabus of B.Sc. (Mathematics) 4 Year Program**

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### **CURRICULUM CONTENT**

#### **UNIT 1: Work, Energy and Collisions**

Work and Kinetic Energy Theorem. Conservative and non-conservative forces. Potential Energy. Energy diagram. Stable and unstable equilibrium. Elastic potential energy. Force as gradient of potential energy. Work & Potential energy. Work done by non-conservative forces. Law of conservation of Energy. Elastic and inelastic collisions between particles. **7L**

#### **UNIT 2**

Angular momentum of a particle and system of particles. Torque. Principle of conservation of angular momentum. Rotation about a fixed axis. Moment of Inertia. Calculation of moment of inertia for rectangular, cylindrical and spherical bodies. Kinetic energy of rotation. Motion involving both translation and rotation

**Elasticity:** Relation between Elastic constants. Twisting torque on a Cylinder or Wire.

**10 L**

#### **UNIT 3**

Law of gravitation. Gravitational potential energy. Inertial and gravitational mass. Potential and field due to spherical shell and solid sphere.

Motion of a particle under a central force field. Two-body problem and its reduction to one-body problem and its solution. The energy equation and energy diagram. Kepler's Laws. Satellite in circular orbit and applications. Geosynchronous orbits. Weightlessness. Basic idea of global positioning system (GPS). **9 L**

#### **UNIT 4**

Non-inertial frames and fictitious forces. Uniformly rotating frame. Laws of Physics in rotating coordinate systems. Centrifugal force. Coriolis force and its applications. Components of Velocity and Acceleration in Cylindrical and Spherical Coordinate Systems **5 L**

#### **UNIT 5**

Postulates of Special Theory of Relativity. Lorentz Transformations. Simultaneity and order of events. Lorentz contraction. Time dilation. Relativistic transformation of velocity, frequency and wave number. Relativistic addition of velocities. Variation of mass with velocity. Massless Particles. Mass-energy Equivalence. Transformation of Energy and Momentum. **8 L**

#### **Text books**

1. Mechanics, D.S. Mathur, S. Chand & Co., 2012.
2. Introduction to Mechanics, D. Kleppner & R. Kolenkow, Cambridge University Press, 2017.

#### **Reference books**

1. Analytical Mechanics, G.R. Fowles and G.L. Cassiday., Cengage Learning India Pvt. Ltd., 2006.
2. Introduction to Special Relativity, R. Resnick, John Wiley and Sons, 2007.
3. Principles of Mechanics, J.L. Synge & B.A. Griffiths, Andesite Press, 2015.

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## Applicable for Batch: 2023-27

### Ability enhancement courses (AEC) Courses (Semester-I)

Subject Code	HLAN146	Subject Title	Professional Communication						
LTP	202	Credit	3	Subject Category	AEC I	Year	I	Semester	I

#### Course Summary

This course is to enhance the Communication Skills of the students. It also focuses on Basic facets of communication. It introduces the students to LSRW and Non-verbal Language and how to master these aspects to be an effective communicator.

#### Course Objective

- The course aims at developing the LSRW skills of students for effective communication.
- Also, to equip them for a business environment.
- It also focuses on preparing the students to understand and present themselves effectively.

#### UNIT I:

##### **Communication** (7)

Communication: Meaning; Types of Communication: General and Technical Communication; Knowledge and adoption of Non-Verbal cues of communication: Kinesics, Proxemics, Chronemics, Oculistics, Haptics, Paralinguistics; Barriers to Communication: Overcoming strategies.

#### UNIT II:

##### **Listening & Speaking Skills** (4)

Listening Comprehension: Identifying General and Specific information, Note-taking and Drawing Inferences; Introduction to Phonetics: Articulation of Consonants and Vowel sounds.

#### UNIT III:

##### **Reading Skills & Technical Writing Skills** (8)

Reading Strategies and Vocabulary Building; Reading Comprehension; Paragraph Development; Intra-office Correspondence: Notice, Agenda, Minutes and Memorandum; Technical Proposal and Technical Report

#### UNIT IV:

##### **Communication at Work** (7)

Business Letter Writing; Job Application Letter & Resume; Interview Skills; Impression Management; SWOT Analysis; EQ and Its Dimensions,

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### **Learning Outcome**

On successful completion of the course, students will be able to achieve the following:

1. Communicate smoothly
2. Greater self-confidence and knowledge of life skills helps them to develop healthier interpersonal relationships.
3. Present themselves effectively
4. Prepares the students to face future challenges and excel in their personal and professional lives.

### **Text Books**

1. Rizvi, Ashraf. Effective Technical Communication, McGraw Hill, New Delhi. 2005.
2. Raman, Meenakshi and Sangeeta Sharma, Technical Communication: Principles and Practice, 2nd Edition. New Delhi: Oxford University Press. 2011.

### **Reference Books**

1. Aslam, Mohammad. Introduction to English Phonetics and Phonology Cambridge.2003.
2. Ford A, Ruther. Basic Communication Skills; Pearson Education, New Delhi.2013.
3. Gupta, Ruby. Basic Technical Communication, Cambridge University Press, New Delhi.2012.
4. Kameswari, Y. Successful Career Soft Skills and Business English, BS Publications, Hyderabad. 2010.
5. Tyagi, Kavita& Padma Misra. Basic Technical Communication, PHI, New Delhi. 201

### **Lab:**

- Lab 1: Neutralizing Mother Tongue Influence
- Lab 2: Listening (Biographies through software) & Presentation of Biographies
- Lab 3: Listening & Role Play on Situational/ Telephonic Conversation (through software)
- Lab 4: Picture Perception
- Lab 5: Public Speaking
- Lab 6: Group Discussion
- Lab 7: Case Studies
- Lab 8: SWOT Analysis
- Lab 9: Mock Interview
- Lab 10: Final Evaluation

# Course Structure & Syllabus of B.Sc. (Mathematics) 4 Year Program

## Applicable for Batch: 2023-27

### Ability enhancement courses (AEC) Courses (Semester-II)

Subject Code	HLAN246	Subject Title	Human Values and Ethics						
LTP	200	Credit	2	Subject Category	AEC III	Year	II	Semester	III

#### Course Summary

This course will introduce students to the nature of the individual and the relationship between the self and the community. It includes Principles of Interdependence between individuals and society and role of material values in promoting human well-being. It also includes psychological and spiritual values through topics like Humanistic Psychology, religion, concept of Dharma and Spirituality morality, Professional values and developing an open and balanced mind.

#### Course Objectives

- To inculcate the skills of ethical decision making and then to apply these skills to the real and current challenges of the Engineering profession.
- The main objective of the course is to enable the students to understand the need and importance of value-education and education for Human Rights.
- It also aims to develop their inter personal and leadership skills and empower them to develop into evolved human beings.

#### UNIT I

##### INTRODUCTION

(6)

Nature of Value-Crisis in the contemporary Indian society, Meaning, Nature & Types of Values; Sources of Value Formation, Foundational Human Values – Integrity, Freedom, Creativity, Morals, Love and Wisdom, Case Studies Case Studies on the above aspects

#### UNIT II

##### SOCIETAL VALUES & MATERIAL VALUES

(6)

Definition of Society, Units of Society, and Social Consciousness. Concepts & Principles of Interdependence, Conceptualizing 'Good Society' and 'Social Goods' and Corporate Social Responsibility, Role of Material Values in promoting Human Well-being. Role of Science and Technology; Problems of Material Development, Case Studies Case Studies on the above aspects

#### UNIT III

##### PSYCHOLOGICAL & SPIRITUAL VALUES

(6)

Humanistic Psychology; Concept of Intelligence, Emotional Intelligence & Mental health; Cognitive Dissonance & Ego Defense, Maslow's Hierarchy of Human Need; Characteristics of 'Self-Actualizing' persons; Understanding Common Religion & Concept of Dharma and Spirituality; Case Studies Case Studies on the above aspects

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## **Applicable for Batch: 2023-27**

### **UNIT IV**

(6)

#### **PSYCHOLOGICAL & SPIRITUAL VALUES**

Bases for moral Judgments: Customary Morality, Religious Morality, Reflective Morality. Concept of Professional values: Competence, Confidence, Devotion to Duty, Efficiency, Accountability, Respect for learning / Learned, Willingness to Learn, Open and Balanced mind; Team spirit; Willingness for Discussion, Aims, Effort, Avoidance of Procrastination and Slothfulness, Alertness, IEEE; Case Studies Case Studies on the above aspects

#### **Course Outcomes**

On successful completion of the course, students will be able to achieve the following:

1. Students will become more sensitive to their surroundings including both people and nature, with commitment towards what they believe in (human values).
2. Be able to understand how universal values can be uncovered by different means, including scientific investigation, historical research, or public debate and deliberation (what some philosophers call a dialectic method).
3. They will become more aware of their self and their relationships and have better reflective and discerning ability.
4. Be able to understand and discuss the idea of moral relativism and the challenges it poses to universal values.

#### **Textbooks**

1. Human Values - Prof. A.N. Tripathi New Age International, 2009.

#### **Reference Books**

1. Human Values and Professional Ethics - Jayshree, Suresh and B.S. Raghwan , S. Chand Publication, 2011-12

#### **Teaching and Learning Strategy**

All materials (ppts, assignments, labs, etc.) will be uploaded in Moodle. Refer to your course in Moodle for details.

# Course Structure & Syllabus of B.Sc. (Mathematics) 4 Year Program

## Applicable for Batch: 2023-27

### Skill enhancement courses (SEC) Courses (Semester-I)

Department offering the course	Mathematics and Career Development Centre
Course Code	MAF256
Course Title	Aptitude and Skill Enhancement- I
Credits (L:T:P:C)	2:0:0:2
Contact Hours (L:T:P)	2:0:0
Prerequisites (if any)	NIL
Course Basket	Skill Enhancement

### COURSE SUMMARY

This module is focused on providing students hands-on practice on aptitude problems and prepare a stronger fundamental base for Aptitude and Soft Skills capabilities.

### COURSE OBJECTIVES

Prepare a ground for the students to be ready in Quantitative, Logical Aptitude and Verbal Aptitude

Prepare them for becoming confident and corporate-culture fit as present-day workplace requires professionals who are not only well qualified and competent but also possess Soft Skills like interpersonal skills and good presentation skills.

### COURSE OUTCOMES

**On successful completion of the course, students will be able to achieve the following:**

- Develop Leadership & Team Building Skills.
- Receive hands-on guidance to develop an effective CV.
- The students would be able to understand the basic trends of questions asked in the aptitude part of placements.

### Curriculum Content

#### UNIT 1: APTITUDE (Quantitative and Logical)

Progression, logarithm, Quadratic Equations (concept of determinant, real, non-real, rational and conjugate roots); Mensuration

Input Output – Sequential output tracing of logical operations applied on machine input, Ranking and Order- Test - Ordering of measurable attributes like height / weight / performances, etc. Eligibility test, Logical sequences and series, Completion of incomplete pattern, Odd figures

#### UNIT 2: VERBAL APTITUDE

Tenses and Grammar drills.

Creative Writing: Essay, Report Writing, Article, Letters, E-mail: difference between formal and informal tone, appropriate use of transition words, creating a signature, understanding different situations and the responses they require (situation- based writing), Proper use of connectors.

# **Course Structure & Syllabus of B.Sc. (Mathematics) 4 Year Program**

## **Applicable for Batch: 2023-27**

### **UNIT 3: LEADERSHIP & TEAM BUILDING SKILLS**

Importance, How to develop Leadership Skills? Best Leadership & Team Building Examples.

Suggested Activities & Exercises: (i) Leadership Pizza, (ii) Minefield, (iii) Leaders You Admire.

### **UNIT 4: PRESENTATION SKILLS**

Principles of Effective Presentations, Do's and Don'ts of Formal Presentations, How to prepare for a formal presentation, Presentation Exercises a) Welcome speech, c) Farewell Speech, d) Vote of thanks etc.

**Suggested Activities & Games:** (i) Stand Up for Fillers, (ii) Mimes, (iii) Short Speech Challenge.

### **Textbooks**

1. Quantitative Aptitude: How to prepare for Quantitative Aptitude, Arun Sharma, McGraw Hill, 8th edition-2018.
2. Logical Reasoning: A Modern Approach to Verbal & Non-Verbal Reasoning by R.S. Aggarwal, S Chand Publishing; 2nd Colour edition-2018.
3. Verbal Aptitude: English is Easy- Chetanand Singh, BSC Publication-2018

### **Reference Books**

1. Quantitative Aptitude: Quantitative Aptitude for Competitive Examinations- R.S. Agarwal S. Chand Publications-2018.
2. Quantitative Aptitude: Quantitative Aptitude- Saurabh Rawat and Anushree Sah Rawat Savera Publishing House, 1st edition-2016.
3. Logical Reasoning: Analytical & Logical Reasoning by Peeyush Bhardwaj-Arihant Publications; 4th edition-2015.
4. Logical Reasoning: Analytical Reasoning by M.K.Pandey BSC publishing; 3rd edition - 2009.
5. Verbal Aptitude: Oxford Guide to English Grammar- John Eastwood, Oxford University Press-2003.
6. Soft Skills: Talk like Ted – Carmine Gallo, St. Martin's Press.
7. Soft Skills: No Excuses – Dr Wayne Dyer, Hay House Inc.

# Course Structure & Syllabus of B.Sc. (Mathematics) 4 Year Program

## Applicable for Batch: 2023-27

### Skill enhancement courses (SEC) Courses (Semester-II)

Department offering the course	Mathematics
Course Code	MAFN119
Course Title	Introduction to MATLAB
Credits (L:T:P:C)	2:0:2:3
Contact Hours (L:T:P)	2:0:2
Prerequisites (if any)	None
Course Basket	Skill Enhancement

#### Course Summary

#### Course Objective

The objective of this course is to introduce the students with basics of MATLAB, curve plotting and use of basic commands to solve various algebraic and differential equations through MATLAB.

#### Course Outcomes

After successful completion of this course students will be able to

- Understand the basics functions of MATLAB.
- Plot the 2D, 3D figures.
- Use basic commands of MATLAB.
- Solve various differential equations using MATLAB.

#### Curriculum Content

##### Unit I

Introduction to MATLAB: vector and matrix generation, subscripting and the colon notation, matrix and array operations and their manipulations, introduction to some inbuilt functions related to array operations. m-files: scripts and functions, editing, saving m-files, and interaction between them.

##### Unit II

Two & three-dimensional graphics: basic plots, change in axes and annotation in a figure, multiple plots in a figure, saving and printing figures, mesh plots, surface plots and their variants.

##### Unit III

Relational and logical operators: flow control using various statements and loops including If-End statement, If-Else-End statement, nested If-Else-End statement, For-End and While-End loops with Break commands.

# **Course Structure & Syllabus of B.Sc. (Mathematics) 4 Year Program**

## **Applicable for Batch: 2023-27**

### **Unit IV**

Introduction to built in functions: related to matrix inversion, eigenvalues, eigenvectors, condition number; for data representation: bar charts, histograms, pie chart, stem plots etc; for solving various type of differential equations; for specialized plotting e.g., contour plots, sphere, and animations.

### **Text Books**

1. Getting Started with MATLAB: A Quick Introduction for Scientists and Engineers by Rudra Pratap, Oxford University Press.

### **Reference Books**

1. Applied Numerical Methods with Matlab for Engineers and Scientists by Steven Chapra, McGraw Hill.
2. MATLAB: An introduction with applications: Amos Gilat, 5th Edition, Wiley India.

# Course Structure & Syllabus of B.Sc. (Mathematics) 4 Year Program

## Applicable for Batch: 2023-27

Value added courses common for all UG Courses (Semester-I)

Subject Code	HLAN148	Subject Title	Indian Constitution and Polity						
LTP	3 0 0	Credit	3	Subject Category	Value Added	Year	I	Semester	I

### Course Summary

The Constitution of India is the supreme law of India. The document lays down the framework demarcating fundamental political code, structure, procedures, powers, and duties of government institutions and sets out fundamental rights, directive principles, and the duties of citizens. The course will provide knowledge of their constitutional rights to the students and also familiarize the students with the features of the Indian Constitution.

### Course Objective

- To familiarize the students with the features of the Indian Constitution
- To provide a knowledge of their constitutional rights

### UNIT I: (8)

#### Introduction

Constitution: Meaning of the Term; Basic Features Indian Constitution: Sources and Constitutional History, Features: Citizenship, Preamble, Fundamental Rights and Duties, Directive, Principles of State Policy.

### UNIT II: (8)

#### Union Government and its Administration

Structure of the Indian Union: Federalism, Centre-State relationship; President: Role, Power and Position; PM and Council of Ministers; Lok Sabha, Rajya Sabha, Parliament and Judiciary.

### UNIT III: (6)

#### State Government and its Administration

Governor: Role and Position; CM and Council of Ministers; State Secretariat: Organization, Structure and Functions.

### UNIT-IV: (8)

#### Local Administration

District's Administration head: Role and Importance; Municipalities: Introduction, Panchayat Raj: Introduction; Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed Officials; Election Commission: Role and Functioning.

### Course Outcomes

**On successful completion of the course, students will be able to achieve the following:**

- Enable the students to protect their rights
- The students will be engaged in the political system of India

# **Course Structure & Syllabus of B.Sc. (Mathematics) 4 Year Program**

## **Applicable for Batch: 2023-27**

### **Text Books**

1. Abbas, H., Kumar, R. & Alam, M. A. (2011) Indian Government and Politics. New Delhi: Pearson, 2011.
2. Chandhoke, N. & Priyadarshi, P. (eds.) (2009) Contemporary India: Economy, Society, Politics. New Delhi: Pearson.

### **Reference Books**

1. Chakravarty, B. & Pandey, K. P. (2006) Indian Government and Politics. New Delhi: Sage.
2. Chandra, B., Mukherjee, A. & Mukherjee, M. (2010) India After Independence. New Delhi: Penguin.
3. Singh, M.P. & Saxena, R. (2008) Indian Politics: Contemporary Issues and Concerns. New Delhi: PHI Learning.
4. Vanaik, A. & Bhargava, R. (eds.) (2010) Understanding Contemporary India: Critical Perspectives. New Delhi: Orient Blackswan.

### **Value added courses common for all UG Courses (Semester-II)**