OSMANIA UNIVERSITY
HYDERABAD,TELANGANA

Mathematics Course Structure

(B.Sc. Common Core Syllabus for All Universities of Telangana State for the Students Admitted from the Academic Year 2019-2020 Batch onwards)

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1 B.Sc. Course Structure Template

OSMANIA UNIVERSITY, HYDERABAD

B.A/B.Sc. Mathematics Course Structure

(Common Core Syllabus for All Universities of Telangana State for the Students Admitted from the Academic Year 2019-20 Batch onwards)

Paper	Semester	Subject	Hours/ per week	Hours/per week		Max. Marks	Credits
				Theory	*Tutorials		
DSC - I	I	Differential & Integral Calculus	6	5	1	100	5
DSC - II	II	Differential Equations	6	5	1	100	5
DSC - III	III	Real Analysis	6	5	1	100	5
DSC - IV	IV	Algebra	6	5	1	100	5
DSC - V	V	Linear Algebra	6	5	1	100	5
DSE – VI(A)	VI	(A) Numerical Analysis	6	5	1	100	5
DSE – VI(B)	VI	(B) Integral Transforms	6	5	1	100	5
DSE – VI(C)	VI	(C) Analytical Solid Geometry	6	5	1	100	5
SEC-I	III	**Communication Skills** (OR) **Professional Skills**	2	2	-	50	2
SEC-II	III	(A) Theory of Equations (OR) (B) Logic & Sets	2	2	-	50	2
SEC-III	IV	**Leadership & Management Skill** (OR) **Universal Human Values**	2	2	-	50	2
SEC-IV	IV	(A) Number Theory (OR) (B) Vector Calculus	2	2	-	50	2
Generic Elective	V	(A) Basic Mathematics (OR) (B) Mathematics for Economics & Finance	4	4	-	100	4
Project/ Optional	VI **	Mathematical Modelling	4	4	-	100	4

***Tutorials:** Problems solving session for each 20 student's one batch.

****The students are required to opt either the optional paper **Mathematical Modeling** or **Project**.

SEMESTER-I

1.1 Differential and Integral Calculus

(w.e.f. academic year 2019-20)

DSC-1A **BS:101**

Theory: 5 credits and Tutorials: 0 credits
Theory: 5 hours /week and Tutorials: 1 hours /week

Objective: The course is aimed at exposing the students to some basic notions in differential calculus.
Outcome: By the time students complete the course they realize wide ranging applications of the subject.

Unit- I
Partial Differentiation: Introduction - Functions of two variables - Neighborhood of a point (a, b) - Continuity of a Function of two variables, Continuity at a point - Limit of a Function of two variables - Partial Derivatives - Geometrical representation of a Function of two Variables - Homogeneous Functions.

Unit- II
Theorem on Total Differentials - Composite Functions - Differentiation of Composite Functions - Implicit Functions - Equality of $f_{xy}(a, b)$ and $f_{yx}(a, b)$ - Taylor's theorem for a function of two Variables - Maxima and Minima of functions of two variables – Lagrange's Method of undetermined - multipliers.

Unit- III
Curvature and Evolutes: Introduction - Definition of Curvature - Radius of Curvature - Length of Arc as a Function, Derivative of arc - Radius of Curvature - Cartesian Equations - Newtonian Method - Centre of Curvature - Chord of Curvature.
Evolutes: Evolutes and Involutes - Properties of the evolute.
Envelopes: One Parameter Family of Curves - Consider the family of straight lines - Definition - Determination of Envelope.

Unit- IV
Lengths of Plane Curves: Introduction - Expression for the lengths of curves $y = f(x)$ - Expressions for the length of arcs $x = f(y)$; $x = f(t)$, $y = \phi(t)$; $r = f(\theta)$
Volumes and Surfaces of Revolution: Introduction - Expression for the volume obtained by revolving about either axis - Expression for the volume obtained by revolving about any line - Area of the surface of the frustum of a cone - Expression for the surface of revolution - Pappus Theorems - Surface of revolution.

Text:

- Shanti Narayan, P.K. Mittal *Differential Calculus, S.CHAND, NEW DELHI*
- Shanti Narayan *Integral Calculus, S.CHAND, NEW DELHI*
- References:
- William Anthony Granville, Percey F Smith and William Raymond Longley; *Elements of the*

differential and integral calculus

- Joseph Edwards , *Differential calculus for beginners*
- Smith and Minton, *Calculus*
- Elis Pine, *How to Enjoy Calculus*
- Hari Kishan, *Differential Calculus*

SEMESTER-II

1.2 Differential Equations

(w.e.f. academic year 2019-20)

DSC-1B **BS:201**

Theory: 5 credits and Tutorials: 0 credits
Theory: 5 hours /week and Tutorials: 1 hours /week

Objective: The main aim of this course is to introduce the students to the techniques of solving differential equations and to train to apply their skills in solving some of the problems of engineering and science.
Outcome: After learning the course the students will be equipped with the various tools to solve few types differential equations that arise in several branches of science.

Unit- I
Differential Equations of first order and first degree: Introduction - Equations in which Variables are Separable - Homogeneous Differential Equations - Differential Equations Reducible to Homogeneous Form - Linear Differential Equations - Differential Equations Reducible to Linear Form - Exact differential equations - Integrating Factors - Change in variables - Total Differential Equations - Simultaneous Total Differential Equations - Equations of the form $\frac{dx}{P} = \frac{dy}{Q} = \frac{dz}{R}$

Unit- II
Differential Equations first order but not of first degree: Equations Solvable for p - Equations Solvable for y - Equations Solvable for x - Equations that do not contain x (or y)- Equations Homogeneous in x and y - Equations of the First Degree in x and y - Clairaut's equation.
Applications of First Order Differential Equations : Growth and Decay - Dynamics of Tumour Growth - Radioactivity and Carbon Dating - Compound Interest - Orthogonal Trajectories.

Unit- III
Higher order Linear Differential Equations: Solution of homogeneous linear differential equations with constant coefficients - Solution of non-homogeneous differential equations $P(D)y = Q(x)$ with constant coefficients by means of polynomial operators when $Q(x) = be^{ax}$, $b \sin ax/b \cos ax$, bx^k, $V e^{ax}$ - Method of undetermined coefficients.

Unit- IV
Method of variation of parameters - Linear differential equations with non constant coefficients - The Cauchy - Euler Equation - Legendre's Linear Equations - Miscellaneous Differential Equations.
Partial Differential Equations: Formation and solution- Equations easily integrable - Linear equations of first order.

Text:

- Zafar Ahsan,*Differential Equations and Their Applications*

References

Frank Ayres Jr, *Theory and Problems of Differential Equations.*

- Ford, L.R ; *Differential Equations.*

- Daniel Murray, *Differential Equations.*
- S. Balachandra Rao, *Differential Equations with Applications and Programs.*
- Stuart P Hastings, J Bryce McLead; *Classical Methods in Ordinary Differential Equations.*

SEMESTER-III

1.3 Real Analysis

(w.e.f. academic year 2020-21)

DSC-1C **BS:301**

Theory: 5 credits and Tutorials: 0 credits
Theory: 5 hours /week and Tutorials:1hours/week

Objective: The course is aimed at exposing the students to the foundations of analysis which will be useful in understanding various physical phenomena.
Outcome: After the completion of the course students will be in a position to appreciate beauty and applicability of the course.

Unit- I
Sequences: Limits of Sequences- A Discussion about Proofs-Limit Theorems for Sequences-Monotone Sequences and Cauchy Sequences -Subsequences-Lim sup' s and Lim inf' s-Series-Alternating Series and Integral Tests .

Unit- II
Continuity: Continuous Functions -Properties of Continuous Functions -Uniform Continuity - Limits of Functions

Unit- III
Differentiation: Basic Properties of the Derivative - The Mean Value Theorem - L' Hospital Rule – Taylor' s Theorem.

Unit- IV
Integration : The Riemann Integral - Properties of Riemann Integral-Fundamental Theorem of Calculus.

Text:

- Kenneth A Ross,*Elementary Analysis-The Theory of Calculus*

References:

- S.C. Malik and Savita Arora, *Mathematical Analysis, Second Edition, Wiley Eastern Limited, New Age International (P) Limited, New Delhi, 1994.*
- William F. Trench, *Introduction to Real Analysis*
- Lee Larson , *Introduction to Real Analysis I*
- Shanti Narayan and Mittal, *Mathematical Analysis*
- Brian S. Thomson, Judith B. Bruckner, Andrew M. Bruckner; *Elementary Real analysis*
- Sudhir R., Ghorpade, Balmohan V., Limaye; *A Course in Calculus and Real Analysis*

SEMESTER-IV

1.4 Algebra

(w.e.f. academic year 2020-21)

DSC-1D **BS:401**

Theory: 5 credits and Tutorials: 0 credits
Theory: 5 hours /week and
Tutorials: 1 hours /week

Objective: The course is aimed at exposing the students to learn some basic algebraic structures like groups, rings etc.
Outcome: On successful completion of the course students will be able to recognize algebraic structures that arise in matrix algebra, linear algebra and will be able to apply the skills learnt in understanding various such subjects.

Unit- I
Groups: Definition and Examples of Groups- Elementary Properties of Groups-Finite Groups - Subgroups -Terminology and Notation -Subgroup Tests - Examples of Subgroups.
Cyclic Groups: Properties of Cyclic Groups - Classification of Subgroups Cyclic Groups.

Unit- II
Permutation Groups: Definition and Notation -Cycle Notation-Properties of Permutations -A Check Digit Scheme Based on D_5. Isomorphisms ; Motivation- Definition and Examples -Cayley's Theorem Properties of Isomorphisms -Automorphisms-Cosets and Lagrange's Theorem Properties of Cosets 138 - Lagrange's Theorem and Consequences-An Application of Cosets to Permutation Groups -The Rotation Group of a Cube and a Soccer Ball.

Unit- III
Normal Subgroups and Factor Groups: Normal Subgroups-Factor Groups -Applications of Factor Groups -Group Homomorphisms - Definition and Examples -Properties of Homomorphisms -The First Isomorphism Theorem.
Introduction to Rings: Motivation and Definition -Examples of Rings -Properties of Rings - Subrings.
Integral Domains: Definition and Examples - Fields – Characteristics of a Ring.

Unit- IV
Ideals and Factor Rings: Ideals -Factor Rings -Prime Ideals and Maximal Ideals.
Ring Homomorphisms: Definition and Examples-Properties of Ring- Homomorphisms.

Text:

- Joseph A Gallian, *Contemporary Abstract algebra (9th edition)*

References:

- Bhattacharya, P.B Jain, S.K.; and Nagpaul, S.R,*Basic Abstract Algebra*
- Fraleigh, J.B, *A First Course in Abstract Algebra.*
- Herstein, I.N, *Topics in Algebra*
- Robert B. Ash, *Basic Abstract Algebra*
- I Martin Isaacs, *Finite Group Theory*
- Joseph J Rotman, *Advanced Modern Algebra*

SEMESTER-V

1.5 Linear Algebra

(w.e.f. academic year 2021-22)

DSC-E **BS:501**

Theory: 5 credits and Tutorials: 0 credits
Theory: 5 hours /week and Tutorials: 1 hours /week

Objective: The students are exposed to various concepts like vector spaces , bases , dimension, Eigen values etc.
Outcome: After completion this course students appreciate its interdisciplinary nature.

Unit- I
Vector Spaces: Vector Spaces and Subspaces -Null Spaces, Column Spaces, and Linear Transformations -Linearly Independent Sets; Bases -Coordinate Systems -The Dimension of a Vector Space

Unit- II
Rank-Change of Basis - Eigenvalues and Eigenvectors - The Characteristic Equation

Unit- III
Diagonalization -Eigenvectors and Linear Transformations -Complex Eigenvalues - Applications to Differential Equations.

Unit- IV
Orthogonality and Least Squares : Inner Product, Length, and Orthogonality -Orthogonal Sets -Orthogonal Projections - The Gram-Schmidt Process.

Text:

- David C Lay,*Linear Algebra and its Applications* 4e

References:

- S Lang, *Introduction to Linear Algebra*
- Gilbert Strang , *Linear Algebra and its Applications*
- Stephen H. Friedberg, Arnold J. Insel, Lawrence E. Spence; *Linear Algebra*
- Kuldeep Singh; *Linear Algebra*
- Sheldon Axler; *Linear Algebra Done Right*

SEMESTER-VI

1.6 Numerical Analysis

(w.e.f. academic year 2021-22)

DSE-VI(A) **BS:601/A**

Theory: 5 credits and Tutorials: 0 credits
Theory: 5 hours /week and Tutorials: 1 hours /week

Objective: Students will be made to understand some methods of numerical analysis.
Outcome: Students realize the importance of the subject in solving some problems of algebra and calculus.

Unit- I

Errors in Numerical Calculations - **Solutions of Equations in One Variable**: The Bisection Method - The Iteration Method - The Method of False Position-Newton's Method - Muller's Method - solution of Systems of Nonlinear Equations.

Unit- II

Interpolation and Polynomial Approximation: Interpolation - Finite Differences - Differences of Polynomials - Newton's formula for Interpolation - Gauss's central differences formulae - Stirling's and Bessel's formula - Lagrange's Interpolation Polynomial - Divided Differences - Newton's General Interpolation formula - Inverse Interpolation.

Unit- III

Curve Fitting: Least Square Curve Fitting: Fitting a Straight Line-Nonlinear Curve Fitting.
Numerical Differentiation and Integration: Numerical Differentiation - Numerical Integration: Trapezoidal Rule-Simpson's 1/3rd-Rule and Simpson's 3/8th-Rule - Boole's and Weddle's Rule - Newton's Cotes Integration Formulae.

Unit- IV

Numerical Solutions of Ordinary Differential Equations: Taylor's Series Method - Picard's Method - Euler's Methods - Runge Kutta Methods.

Text:

- S.S.Sastry,*Introductory Methods of Numerical Analysis, PHI*

References:

- Richard L. Burden and J. Douglas Faires,*Numerical Analysis* (9*e*)
- M K Jain, S R K Iyengar and R K Jain, *Numerical Methods for Scientific and Engineering computation*
- B.Bradie , *A Friendly introduction to Numerical Analysis*

SEMESTER-VI

1.7 Integral Transforms

(w.e.f. academic year 2021-22)

DSE – V I (B) **BS:601/B**

Theory: 5 credits and Tutorials: 0 credits
Theory: 5 hours /week and Tutorials: 1 hours /week

Objective: Students will be exposed to Integral Transforms. The students also learning the Applications of Laplace Transforms to Differential Equations which arises in Physics and Engineering Problems.
Outcome: Students apply their knowledge to solve some problems on special functions and Differential Equations by using the Integral Transforms.

Unit- I
Laplace Transforms-Definition-Existence theorem-Laplace transforms of derivatives and integrals - Periodic functions and some special functions.

Unit- II
Inverse Transformations - Convolution theorem - Heaviside' s expansion formula.

Unit- III
Applications to ordinary differential equations - solutions of simultaneous ordinary differential equations - Applications to Partial differential equations.

Unit- IV
Fourier Transforms- Sine and cosine transforms-Inverse Fourier Transforms.

Text:

- Vasishtha and Gupta,*Integral Transforms, Krishna Prakashan Media(P), Ltd,Meerut* (2e)

SEMESTER-VI

1.8 Analytical Solid Geometry

(w.e.f. academic year 2021-22)

DSE – VI(C) **BS:601/C**

Theory: 5 credits and Tutorials: 0 credits
Theory: 5 hours /week and Tutorials: 1 hours /week

Objective: Students learn to describe some of the surfaces by using analytical geometry.
Outcome: Students understand the beautiful interplay between algebra and geometry.

Unit- I
Sphere: Definition-The Sphere Through Four Given Points-Equations of a Circle- Intersection of a Sphere and a Line-Equation of a Tangent Plane-Angle of Intersection of Two Spheres-Radical Plane.

Unit- II
Cones and Cylinders: Definition-Condition that the General Equation of second degree Represents a Cone-Cone and a Plane through its Vertex -Intersection of a Line with a Cone.

Unit- III
The Right Circular Cone-The Cylinder- The Right Circular Cylinder.

Unit- IV
The Conicoid: The General Equation of the Second Degree-Intersection of Line with a Conicoid-Plane of contact-Enveloping Cone and Cylinder.

Text:

- Shanti Narayan and P K Mittal,*Analytical Solid Geometry* (17*e*)

References:

- Khaleel Ahmed, *Analytical Solid Geometry*
- S L Loney , *Solid Geometry*
- Smith and Minton, *Calculus*

Course 1: Communication Skills

Context and Justification :

Communication plays an important role in shaping an individual's life, personal as well as professional. Also it is the backbone of any organisation/institution. Success in life to a considerable extent depends on effective communication skills. In today's world of computers and digital media, a strong communication skill base is essential for learners and for smooth functioning of an organisation.

Objectives :

This course has been developed with the following objectives:

1. Identify common communication problems that may be holding learners back
2. Identify what their non-verbal messages are communicating to others
3. Understand role of communication in teaching-learning process
4. Learning to communicate through the digital media
5. Understand the importance of empathetic listening
6. Explore communication beyond language.

Expected Outcome :

By the end of this program participants should have a clear understanding of what good communication skills are and what they can do to improve their abilities.

Credit: 02

Duration: 30 Hours

Number & Titles of Modules:

Total of 7 Modules

Module 1	**Listening**	**4 Hours**
Module 2	**Speaking**	**6 Hours**
Module 3	**Reading**	**3 Hours**
Module 4	**Writing and different modes of writing**	**4 Hours**
Module 5	**Digital Literacy**	**4 Hours**
Module 6	**Effective use of Social Media**	**4 Hours**
Module 7	**Non-verbal communication**	**5 Hours**

Module Outline :

Module 1: Listening **4 Hours**

- Techniques of effective listening
- Listening and comprehension
- Probing questions
- Barriers to listening

Module 2: Speaking **6 Hours**

- Pronunciation
- Enunciation
- Vocabulary
- Fluency
- Common Errors

Module 3: Reading **3 Hours**

- Techniques of effective reading
- Gathering ideas and information from a given text
    i. Identify the main claim of the text
    ii. Identify the purpose of the text
    iii. Identify the context of the text
    iv. Identify the concepts mentioned
- Evaluating these ideas and information
    i. Identify the arguments employed in the text
    ii. Identify the theories employed or assumed in the text
- Interpret the text
    i. To understand what a text says
    ii. To understand what a text does
    iii. To understand what a text means

Module 4: Writing and different modes of writing **4 Hours**

- Clearly state the claims
- Avoid ambiguity, vagueness, unwanted generalisations and oversimplification of issues
- Provide background information
- Effectively argue the claim
- Provide evidence for the claims
- Use examples to explain concepts
- Follow convention
- Be properly sequenced
- Use proper signposting techniques
- Be well structured
    i. Well-knit logical sequence
    ii. Narrative sequence
    iii. Category groupings

- Different modes of Writing
    i. E-mails
    ii. Proposal writing for Higher Studies
    iii. Recording the proceedings of meetings
    iv. Any other mode of writing relevant for learners

Module 5: Digital Literacy **4 Hours**

- Role of Digital literacy in professional life
- Trends and opportunities in using digital technology in workplace
- Internet Basics
- Introduction to MS Office tools
    i. Paint
    ii. Office
    iii. Excel
    iv. Powerpoint

Module 6: Effective use of Social Media **4 Hours**

- Introduction to social media websites
- Advantages of social media
- Ethics and etiquettes of social media
- How to use Google search better
- Effective ways of using Social Media
- Introduction to Digital Marketing

Module 7: Non-verbal communication **5 Hours**

- Meaning of non-verbal communication
- Introduction to modes of non-verbal communication
- Breaking the misbeliefs
- Open and Closed Body language
- Eye Contact and Facial Expression
- Hand Gestures
- Do's and Don'ts
- Learning from experts
- Activities-Based Learning

Pedagogy : Instructor-Led Training, Supplemented by Online Platform (SWAYAM)

Materials : Teaching & Learning

Assessment : Paper-Based or Online Assessment

Bibliography &Suggested Reading including audio video material :

Books

- Sen Madhucchanda (2010), *An Introduction to Critical Thinking*, Pearson, Delhi
- Silvia P. J. (2007), *How to Read a Lot*, American Psychological Association, Washington DC

Course 2: Professional Skills

Context with Justification :

One of the significant outcomes of Higher Education is to prepare an individual for entering the job/employment market. Besides knowledge and skills required for a particular job/occupation, professional skills are also required for an individual to be gainfully employed for a successful and satisfied life. Professional skills are part of life skills. An individual should be able to demonstrate professional skills involving the use of intuitive, logical and critical thinking, communication and interpersonal skills, not limited to cognitive/creative skills. These skills, behaviour and quality of output enhance employability.

The career skills empower an individual with ability in preparing an appropriate resume, addressing the necessary gaps for facing interviews and actively and effectively participating in group discussion thereof, etc. It is also of significant importance that students /individuals possess the know- how to explore career opportunities for themselves, considering their innate strengths and weaknesses.

It is important that the students/individuals are well prepared to take on new challenges and opportunities. With the increasing use of technology in the way we live, learn and work, it is critical for students/individuals to be able to utilise basic computing concepts and also have and espouse excellent Team Skills. Collaborating and working together can assist in resolving complex problems, which allow/offer individuals an opportunity to articulate new ideas and perspectives. It further allows allow learner / individuals design, develop, problem solve and to adapt to situations based on their experience and skills.

Credit: 02

Duration:30 hours

The Course Professional Skills is divided into two parts:

a) Career Skills

b) Team Skills

A. Career Skills

Objectives :

The Objectives of the course are to help students/candidates:

1. Acquire career skills and fully pursue to partake in a successful career path
2. Prepare good resume, prepare for interviews and group discussions
3. Explore desired career opportunities in the employment market in consideration of an individual SWOT.

Expected Outcomes :

At the end of this course the students will be able to:

1. Prepare their resume in an appropriate template without grammatical and other errors and using proper syntax
2. Participate in a simulated interview
3. Actively participate in group discussions towards gainful employment
4. Capture a self - interview simulation video regarding the job role concerned
5. Enlist the common errors generally made by candidates in an interview
6. Perform appropriately and effectively in group discussions
7. Explore sources (online/offline) of career opportunities
8. Identify career opportunities in consideration of their own potential and aspirations
9. Use the necessary components required to prepare for a career in an identified occupation (as a case study).

Duration: 15 Hours

Number & Titles of Modules:

Module 1	**Resume Skills**	**3 Hours**
Module 2	**Interview Skills**	**5 Hours**
Module 3	**Group Discussion Skills**	**4 Hours**
Module 4	**Exploring Career Opportunities**	**3 Hours**

Module Outline :

Module 1: Resume Skills — 3 Hours

i. Resume Skills : Preparation and Presentation

- Introduction of resume and its importance
- Difference between a CV, Resume and Bio data
- Essential components of a good resume

ii. Resume skills : common errors

- Common errors people generally make in preparing their resume
- Prepare a good resume of her/his considering all essential components

Module 2: Interview Skills — 5 Hours

i. Interview Skills : Preparation and Presentation

- Meaning and types of interview (F2F, telephonic, video, etc.)
- Dress Code, Background Research, Do's and Don'ts
- Situation, Task, Approach and Response (STAR Approach) for facing an interview
- Interview procedure (opening, listening skills, closure, etc.)
- Important questions generally asked in a job interview (open and closed ended questions)

ii. **Interview Skills : Simulation**

- Observation of exemplary interviews
- Comment critically on simulated interviews

iii. **Interview Skills : Common Errors**

- Discuss the common errors generally candidates make in interview
- Demonstrate an ideal interview

Module 3: Group Discussion Skills **4 Hours**

- Meaning and methods of Group Discussion
- Procedure of Group Discussion
- Group Discussion- Simulation
- Group Discussion - Common Errors

Module 4: Exploring Career Opportunities **3 Hours**

- Knowing yourself – personal characteristics
- Knowledge about the world of work, requirements of jobs including self-employment.
- Sources of career information
- Preparing for a career based on their potentials and availability of opportunities

Pedagogy : Besides Face to Face lectures (theory would be limited only to 20% of the component and remaining 80% would be practical oriented), the focus would be primarily on blended /hybrid learning. This could include a flipped classroom approach that leverages project-based learning, demonstration, group discussion, simulations etc.

Materials : Audio video materials, Online Platform (SWAYAM), FutureSkills Platform, Used Cases & Case Studies etc.

Assessment: Online evaluation, demonstration, assignments : Some components could be aligned to NOS (SSC/N9005) IT-ITeS Sector . The questions posed to the students would be a mix of MCQs, scenario-based, logical reasoning, comprehension, simulations, etc. Do check the assessment model and sample assessment at (http://nac.nasscom.in/)

Bibliography & Suggested Reading including audio video material :
Please check IT-ITeS Sector Skills Council readiness programs namely

- Foundation Skills In IT (FSIT) - Refer the websites like https://www.sscnasscom.com/ssc-projects/capacity-building-and-development/training/fsit/ and
- Global Business Foundation Skills (GBFS) – Refer websites like https://www.sscnasscom.com/ssc-projects/capacity-building-and-development/training/gbfs/

B. Team Skills

Objectives :

The objectives of the course is to make learners:

1. Understand the significance of Team Skills and help them in acquiring them
2. To help them design, develop and adapt to situations as an individual and as a team.

Expected Outcomes :

By the end of this course the learners/candidates will be able to:

1. Use common technology messaging tools that are used in enterprises for flow of information and transition from command and control to informal communication during an online/offline team session
2. Actively use and operate online team communication tools: Webinar, Skype, Zoom, Google hangout etc
3. Appreciate and demonstrate Team Skills
4. Participate in a digital lifestyle conversant with computers, applications, Internet and nuances of cyber security
5. Explore (online) and identify career opportunities in consideration of their own potential and aspirations.
6. Discuss and articulate the key requirements of an entrepreneurial exercise
7. Empathise and trust colleagues for improving interpersonal relations
8. Engage in effective communication by respecting diversity and embracing good listening skills
9. Distinguish the guiding principles for communication in a diverse, smaller internal world
10. Practice interpersonal skills for better relations with seniors, juniors, peers and stakeholders
11. Project a good personal image and social etiquette so as to have a positive impact on building of one's chosen career
12. Generate, share and maximise new ideas with the concept of brainstorming and the documentation of key critical ideas/thoughts articulated and action points to be implemented with timelines in a team discussion (as MOM) in identified applicable templates.

Duration: 15 Hours

Number & Titles of Modules:

Module 1	**Presentation Skills**	**5 Hours**
Module 2	**Trust and Collaboration**	**2 Hour**
Module 3	**Listening as a Team Skill**	**2 hour**
Module 4	**Brainstorming**	**2 Hour**
Module 5	**Social and Cultural Etiquettes**	**2 Hour**
Module 6	**Internal Communication**	**2 Hour**

Module Outline :

Module 1: Presentation Skills **5 Hours**

- Types of presentations
- Internal and external presentation
- Knowing the purpose
- Knowing the audience
- Opening and closing a presentation
- Using presentation tools
- Handling questions
- Presentation to heterogenic group
- Ways to improve presentation skills over time

Module 2: Trust and Collaboration **2 Hours**

- Explain the importance of trust in creating a collaborative team
- Agree to Disagree and Disagree to Agree – Spirit of Team work
- Understanding fear of being judged and strategies to overcome fear

Module 3: Listening as a Team Skill **2 Hours**

- Advantages of Effective Listening
- Listening as a team member and team leader. Use of active listening strategies to encourage sharing of ideas (full and undivided attention, no interruptions, no pre-think, use empathy, listen to tone and voice modulation, recapitulate points, etc.).

Module 4: Brainstorming **2 Hour**

- Use of group and individual brainstorming techniques to promote idea generation.
- Learning and showcasing the principles of documentation of team session outcomes

Module 5: Social and Cultural Etiquette **2 Hour**

- Need for etiquette (impression, image, earn respect, appreciation, etc)
- Aspects of social and cultural/corporate etiquette in promoting teamwork
- Importance of time, place, propriety and adaptability to diverse cultures

Module 6: Internal Communication **2 Hour**

- Use of various channels of transmitting information including digital and physical, to team members.

Pedagogy : Besides Face to Face Lectures (as theory would be limited only to 20% of the component and remaining 80% would be practical oriented), the focus would be primarily on blended learning/hybrid learning. This could include a flipped classroom approach that leverage project based learning, demonstration, group discussion, simulation as well as coaching, seminars and tutorials.

Materials : Audio video materials, Online Platform (SWAYAM), Future Skills platform

Assessment: Written evaluation, demonstration, assignments: Some components aligned to NOS (SSC/N9005) IT-ITeS . The questions posed to the students would be a mix of MCQs, Scenario-based, logical reasoning, comprehension, simulations, etc. Do check the assessment at website like (http://nac.nasscom.in/)

Bibliography & Suggested Reading including audio video material : Please check IT-ITeS Sector Skills Council readiness program namely Global Business Foundation Skills (GBFS) in website (https://www.sscnasscom.com/ssc-projects/capacity-building-and-development/training/gbfs/),and Generic and the entrepreneurial NOS at NSQF Level 4 -7.

1.9 Theory of Equations

(w.e.f. academic year 2020-21)

SEMESTER-III
SEC-II (A)

Theory: 2 credits
Theory: 2 hours /week

Objective: Students learn the relation between roots and coefficients of a polynomial equation, Descartes' s rule of signs in finding the number of positive and negative roots if any of a polynomial equation bsides some other concepts.
Outcome: By using the concepts learnt the students are expected to solve some of the polynomial equations.

Unit- I
Graphic representation of a polynomial-Maxima and minima values of polynomials-Theorems relating to the real roots of equations-Existence of a root in the general equation -Imaginary roots-Theorem determining the number of roots of an equation-Equal roots-Imaginary roots enter equations in pairs-Descartes' rule of signs for positive roots- Descartes' rule of signs for negative roots.

Unit- II
Relations between the roots and coefficients-Theorem-Applications of the theorem-Depression of an equation when a relation exists between two of its roots-The cube roots of unity Symmetric functions of the roots-examples.

Text:

- W.S. Burnside and A.W. Panton, *The Theory of Equations*

References:

- C. C. Mac Duffee, *Theory of Equations*
- Hall and Knight , *Higher Algebra*

1.10 Logic and Sets

(w.e.f. academic year 2020-21)

SEMESTER-III
SEC – II (B)

Theory: 4 credits and Tutorials: 0 credits
Theory: 4 hours /week and
Tutorials: 1 hours/week

Objective: Students learn some concepts in set theory and logic.
Outcome: After the completion of the course students appreciate its importance in the development of computer science.

Unit- I

Basic Connectives and truth tables - Logical equivalence : Laws of Logic - Logical Implication : Rules Inference : The Use of Quantifiers - Quantifiers, Definitions, and proofs of Theorems.

Unit- II

Sets and Subsets - Set Operations and the Laws of Set Theory - Counting and Venn Diagrams - A First Word on Probability - The axioms of Probability - Conditional Probability: Independence - Discrete Random variables .

Text:

- Ralph P Grimaldi,*Discrete and Combinatorial Mathematics* (5*e*)

References:

- P R Halmos, *Naïve Set Theory*
- E Kamke , *Theory of Sets*

Course 3: Leadership and Management Skills

Context with Justification :

Leaders are foundations of the society, who face and win against adversities and odds of life. Through their words and deeds, they show path to others and transform into inspirational role models, affecting social life vividly. In the current times of cut-throat competitions, disbelief in values, techno-centric complex lifestyles, there is a dire need to emphasise the 'human' agency in community living. This can be done by cultivating and nurturing the innate leadership skills of the youth so that they may transform these challenges into opportunities and become torch bearers of the future by developing creative solutions.

Objectives :

The Module is designed to:

- Help students to develop essential skills to influence and motivate others
- Inculcate emotional and social intelligence and integrative thinking for effective leadership
- Create and maintain an effective and motivated team to work for the society
- Nurture a creative and entrepreneurial mindset
- Make students understand the personal values and apply ethical principles in professional and social contexts.

Expected Outcomes :

Upon completion of the course students will be able to:

1. Examine various leadership models and understand/assess their skills, strengths and abilities that affect their own leadership style and can create their leadership vision
2. Learn and demonstrate a set of practical skills such as time management, self management, handling conflicts, team leadership, etc.
3. Understand the basics of entrepreneurship and develop business plans
4. Apply the design thinking approach for leadership
5. Appreciate the importance of ethics and moral values for making of a balanced personality.

Credit: 02

Duration: 30 Hours

Number & Titles of Modules:

Module 1	**Leadership Skills**	**6 Hours**
Module 2	**Managerial Skills**	**6 Hours**
Module 3	**Entrepreneurial Skills**	**6 Hours**
Module 4	**Innovative Leadership and Design Thinking**	**6 Hours**
Module 5	**Ethics and Integrity**	**6 Hours**

Module Outline :

Module 1- Leadership Skills — 6 Hours

a. Understanding Leadership and its Importance

- What is leadership?
- Why Leadership required?
- Whom do you consider as an ideal leader?

b. Traits and Models of Leadership

- Are leaders born or made?
- Key characteristics of an effective leader
- Leadership styles
- Perspectives of different leaders

c. Basic Leadership Skills

- Motivation
- Team work
- Negotiation
- Networking

Module 2 - Managerial Skills — 6 Hours

a. Basic Managerial Skills

- Planning for effective management
- How to organise teams?
- Recruiting and retaining talent
- Delegation of tasks
- Learn to coordinate
- Conflict management

b. Self Management Skills

- Understanding self concept
- Developing self-awareness
- Self-examination
- Self-regulation

Module 3 - Entrepreneurial Skills — 6 Hours

a. Basics of Entrepreneurship

- Meaning of entrepreneurship
- Classification and types of entrepreneurship
- Traits and competencies of entrepreneur

b. Creating Business Plan

- Problem identification and idea generation
- Idea validation
- Pitch making

Module 4 - Innovative Leadership and Design Thinking — 6 Hours

a. Innovative Leadership

- Concept of emotional and social intelligence

- Synthesis of human and artificial intelligence
- Why does culture matter for today's global leaders

b. Design Thinking

- What is design thinking?
- Key elements of design thinking:
  - Discovery
  - Interpretation
  - Ideation
  - Experimentation
  - Evolution.
- How to transform challenges into opportunities?
- How to develop human-centric solutions for creating social good?

Module 5- Ethics and Integrity **6 Hours**

a. Learning through Biographies

- What makes an individual great?
- Understanding the persona of a leader for deriving holistic inspiration
- Drawing insights for leadership
- How leaders sail through difficult situations?

b. Ethics and Conduct

- Importance of ethics
- Ethical decision making
- Personal and professional moral codes of conduct
- Creating a harmonious life

Pedagogy : Pedagogy for the modules is as follows:

1. Leadership Skills - Lectures (augmented with videos); role-plays for leadership models; team building games
2. Managerial Skills - Lectures (augmented with videos), case studies (AMUL, TESLA, Toyota, DMRC, Tata Group, Google, The Mumbai Dabbawala), SWOT analysis, Johari window
3. Entrepreneurial Skills - Lectures (augmented with videos), case studies and practicing business plans
4. Innovative Leadership and Design Thinking- Concept discussion through lecture and videos followed by role-plays and exercises for each set of intelligence, activities using 5 steps – discovery, interpretation, ideation, experimentation, and evolution (Ref.: Workbook of Design Thinking by IDEO)
5. Ethics and Integrity- Experiential learning through stories suggested list (Ahilya Bai, Holkar, Abdul Kalam, Raja Harishchandra, Mahatma Gandhi, Abraham Lincoln), audio visual augmented role plays and storytelling (leaders from varied fields like academics, corporate, social, sports, art, etc.)

Assessment : It can be combination of written evaluation and presentations, including simulations, case studies and business plan.

Bibliography and Suggested Readings :

Books

- Ashokan, M. S. (2015). *Karmayogi: A Bbiography of E. Sreedharan.* Penguin, UK.
- Brown, T. (2012). *Change by Design.* Harper Business
- Elkington, J., & Hartigan, P. (2008). *The Power of Unreasonable People: How Social Entrepreneurs Create Markets that Change the World.* Harvard Business Press.
- Goleman D. (1995). *Emotional Intelligence.* Bloomsbury Publishing India Private Limited
- Kalam A. A. (2003). *Ignited Minds: Unleashing the Power within India.* Penguin Books India
- Kelly T., Kelly D. (2014). *Creative Confidence: Unleashing the Creative Potential Within Us All.* William Collins
- Kurien V., & Salve G. (2012). *I Too Had a Dream.* Roli Books Private Limited
- Livermore D. A. (2010). *Leading with cultural intelligence: The New Secret to Success.* New York: American Management Association
- McCormack M. H. (1986). *What They Don't Teach You at Harvard Business School: Notes From A Street-Smart Executive.* RHUS
- O'Toole J. (2019) *The Enlightened Capitalists: Cautionary Tales of Business Pioneers Who Tried to Do Well by Doing Good.* Harpercollins
- Sinek S. (2009). *Start with Why: How Great Leaders Inspire Everyone to Take Action.* Penguin
- Sternberg R. J., Sternberg R. J., & Baltes P. B. (Eds.). (2004). *International Handbook of Intelligence.* Cambridge University Press.

E-Resources

- Fries, K. (2019). 8 Essential Qualities That Define Great Leadership. *Forbes.* Retrieved 2019-02-15 from https://www.forbes.com/sites/kimberlyfries/2018/02/08/8-essential-qualities-that-define-great-leadership/#452ecc963b63.
- How to Build Your Creative Confidence, Ted Talk by David Kelly - https://www.ted.com/talks/david_kelley_how_to_build_your_creative_confidence
- India's Hidden Hot Beds of Invention Ted Talk by Anil Gupta - https://www.ted.com/talks/anil_gupta_india_s_hidden_hotbeds_of_invention
- Knowledge@Wharton Interviews Former Indian President APJ Abdul Kalam - . "A Leader Should Know How to Manage Failure" https://www.youtube.com/watch?v=laGZaS4sdeU
- Martin, R. (2007). How Successful Leaders Think. *Harvard Business Review, 85*(6): 60.
- NPTEL Course on Leadership - https://nptel.ac.in/courses/122105021/9

Course 4: Universal Human Values

Context with Justification :

Human civilisation is known for the values that it cherishes and practices. Across various times and places, sages, saints and seers, drawing on their experience, developed practices that placed central importance on values, though the names used by them differed, as their languages varied but the spirit was same. Universal human values are values that human beings cherish and hold in common consciously and otherwise in most of the places and times and practice them.

Renunciation is the foundational value. Renunciation or greedlessness has two preconditions: love for all living beings and absence of selfishness. Renunciation is not self-directed but other-directed and is for life in all forms and shapes, for welfare of all. Renunciation begins when selfishness ends. Renunciation to run away from the problems of life is cowardice. Renunciation without action means parasitic life. Also, service can be practised only when renunciation with action begins. Unegoistical service is inconceivable without renunciation; and true service is possible only through love and compassion. Life and death are eternal truths, so is the truth as fact and truth as value. Truth exists between the two ends of life and death and is to be pursued.

Truth, Love, Peace, Non-Violence and **Righteous Conduct** are the Universal Human Values. Renunciation (sacrifice), Compassion and Service are also commonly acceptable human values, which at the operation level have been named differently as sincerity, honesty, righteousness, humility, gratitude, aspiration, prosperity, non-violence, trust, faith, forgiveness, mercy, peace and so on. These are needed for well-being of an individual, society and humanity and ultimately Peace in the world.

This course aims at making learners conscious about universal human values in an integral manner, without ignoring other aspects that are needed for learner's personality development.

Objectives :

The present course deals with meaning, purpose, and relevance of universal human values and how to inculcate and practice them consciously to be a good human being and realise one's potentials.

Learning outcomes :

By the end of the course the learners will be able to:

1. Know about universal human values and understand the importance of values in individual, social circles, career path, and national life.
2. Learn from case studies of lives of great and successful people who followed and practised human values and achieved self-actualisation.
3. Become conscious practitioners of human values.
4. Realise their potential as human beings and conduct themselves properly in the ways of the world.

Credit: 02

Duration: 30 Hours

Number & Titles of Modules:

Module 1: Love & Compassion **5 Hours**

Module 2: Truth **5 Hours**

Module 3: Non-Violence **5 Hours**

Module 4: Righteousness **5 Hours**

Module 5: Peace **4 Hours**

Module 6: Service **3 Hours**

Module 7: Renunciation (Sacrifice) **3 Hours**

Module Outline :

Module 1: Love & Compassion 5 Hours

- Introduction: What is love? Forms of love—for self, parents, family, friend, spouse, community, nation, humanity and other beings, both for living and non-living
- Love and compassion and inter-relatedness
- Love, compassion, empathy, sympathy and non-violence
- Individuals who are remembered in history for practicing compassion and love.
- Narratives and anecdotes from history, literature including local folklore
- Practicing love and compassion: What will learners learn gain if they practice love and compassion? What will learners lose if they don't practice love and compassion?
- Sharing learner's individual and/or group experience(s)
- Simulated Situations
- Case studies

Module 2: Truth 5 Hours

- Introduction: What is truth? Universal truth, truth as value, truth as fact (veracity, sincerity, honesty among others)
- Individuals who are remembered in history for practicing this value
- Narratives and anecdotes from history, literature including local folklore
- Practicing Truth: What will learners learn/gain if they practice truth? What will learners lose if they don't practice it?
- Learners' individual and/or group experience(s)
- Simulated situations
- Case studies

Module 3: Non-Violence 5 Hours

- Introduction: What is non-violence? Its need. Love, compassion, empathy sympathy for others as pre-requisites for non-violence
- Ahimsa as non-violence and non-killing
- Individuals and organisations that are known for their commitment to non-violence
- Narratives and anecdotes about non-violence from history, and literature including local folklore
- Practicing non-violence: What will learners learn/gain if they practice non-violence? What will learners lose if they don't practice it?
- Sharing learner's individual and/or group experience(s) about non-violence
- Simulated situations
- Case studies

Module 4: Righteousness **5 Hours**

- Introduction: What is righteousness?
- Righteousness and *dharma*, Righteousness and Propriety
- Individuals who are remembered in history for practicing righteousness
- Narratives and anecdotes from history, literature including local folklore
- Practicing righteousness: What will learners learn/gain if they practice righteousness? What will learners lose if they don't practice it?
- Sharing learners' individual and/or group experience(s)
- Simulated situations
- Case studies

Module 5: Peace **4 hours**

- Introduction: What is peace? Its need, relation with harmony and balance
- Individuals and organisations that are known for their commitment to peace
- Narratives and Anecdotes about peace from history, and literature including local folklore
- Practicing peace: What will learners learn/gain if they practice peace? What will learners lose if they don't practice it?
- Sharing learner's individual and/or group experience(s) about peace
- Simulated situations
- Case studies

Module 5: Service **3 Hours**

- Introduction: What is service? Forms of service, for self, parents, family, friend, spouse, community, nation, humanity and other beings—living and non-living, persons in distress or disaster.
- Individuals who are remembered in history for practicing this value.
- Narratives and anecdotes dealing with instances of service from history, literature including local folklore
- Practicing service: What will learners learn/gain gain if they practice service? What will learners lose if they don't practice it?
- Sharing learners' individual and/or group experience(s) regarding service
- Simulated situations
- Case studies

Module 6: Renunciation (Sacrifice) **3 Hours**

- Introduction: What is renunciation? Renunciation and sacrifice. Self-restrain and Ways of overcoming greed. Renunciation with action as true renunciation
- Individuals who are remembered in history for practicing this value.
- Narratives and anecdotes from history and literature, including local folklore about individuals who are remembered for their sacrifice and renunciation.
- Practicing renunciation and sacrifice: What will learners learn/gain if they practice Renunciation and sacrifice? What will learners lose if they don't practice it?
- Sharing learners' individual and/or group experience(s)
- Simulated situations
- Case studies

ADDITIONAL PRACTICAL MODULES or OPERATIVE ELECTIVES:

NOTE: The faculty/institution may choose any/some of the following modules keeping in mind the level and specific needs of learners.

Module Outline :

MODULE A - Integral Human Well-Being 5 Hours

Importance of well-being, inter-relatedness of different kinds of well-being and definition of well-being (state of being comfortable, healthy, happy and equanimity)

Well-being and its Kinds

(i) Physical (physical strength and endurance)

(ii) Emotional (ability to respond to emotions and control them)

(iii) Aesthetic (faculty to see and appreciate beauty in all beings)

(iv) Intellectual (rational, logical well-being)

(v) Relational well-being (obligation to self, parents, family society, nation humanity and other beings in the universe; living with others with their acceptance)

(vi) Moral (difference between good and evil and practicing goodness; righteousness)

(vii) Spiritual (thinking beyond self and journey from senses to spiritual level)

Establish and recognise various states of well-being, embedded in different creatures, but consciously understood by humans

Identify the most pronounced emotions in the individual through given activities

Anecdotes/video/activity to help identify different well-beings

Discussion of related values to well-beings: Aesthetics, ethics, gratitude, forgiveness, and spiritual health i.e., thinking beyond senses and self and for the welfare of others

Importance and practice of well-being through case study/ activity

Ways to attain different kinds of well-being

Activities

MODULE B - Yoga & Pranayama 5 Hours

Importance of Yoga and Pranayama

- Yoga and pranayama for integral well-being and balance in life
- Yoga & Pranayama: Introduction
- Mind - Body – Intellect
- Difference between Yoga and Pranayama and their inter-relatedness.

1.11 Number Theory

(w.e.f. academic year 2020-21)

SEMESTER-IV

SEC-IV (A) Theory : 2credits
Theory : 2 hours /week

Objective: Students will be exposed to some of the jewels like Fermat's theorem, Euler's theorem in the number theory.

Outcome: Student uses the knowledge acquired solving some divisor problems.

Unit- I

The Goldbach conjecture - Basic properties of congruences- Binary and Decimal Representation of lntegers - Number Theoretic Functions; The Sum and Number of divisors- The Mobius Inversion Formula- The Greatest integer function.

Unit- II

Euler's generalization of Fermat's Theorem: Euler's Phi function- Euler's theorem SomeProperties of the Euler's Phi function.

Text:

- David M Burton,*Elementary Number Theory* (7*e*)

References:

- Thomas Koshy, *Elementary Number Theory and its Applications*
- Kenneth H Rosen, *Elementary Number Theory*

1.12 Vector Calculus

(w.e.f. academic year 2020-21)

SEMESTER-IV

SEC-IV (B) Theory:2credits
Theory:2hours/week

Objective: Concepts like gradient, divergence, curl and their physical relevance will be taught.
Outcome: Students realize the way vector calculus is used to addresses some of the problems of physics.

Unit- I

Line Integrals: Introductory Example - Work done against a Force-Evaluation of Line Integrals Conservative Vector Fields.

Surface Integrals: Introductory Example : Flow Through a PipeEvaluation of Surface Integrals.

Unit- II

Volume Integrals: Evaluation of Volume integrals

Gradient, Divergence and Curl: Partial differentiation and Taylor series-Partial differentiation Taylor series in more than one variable-Gradient of a scalar field-Gradients, conservative fields and potentials-Physical applications of the gradient.

Text:

- P.C. Matthews, *Vector Calculus*

References:

- G.B. Thomas and R.L. Finney, *Calculus*
- H. Anton, I. Bivens and S. Davis ; *Calculus*
- Smith and Minton, *Calculus*

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SEMESTER-V

1.13 Basic Mathematics

Generic Elective - V(A) **BS:502(A)**

Theory: 4 credits and Tutorials: 0 credits
Theory: 4 hours /week and Tutorials: 1 hours /week

Objective: Students learn the techniques which have been applied successfully to an increasingly wide variety of complex problems in business. Also learn the scientific approach to managerial decision making.

Outcome: Student realizes how the quantitative analysis will be an aid to decision-making process. Also the quantitative analysis how it will be linked with other information in making decisions.

Unit- I
Coordinate Geometry: Fundamentals – Cartesian Coordinates system – Polar Coordinates – Distance Formula – Section Formula -Centroid of a Triangle – Area of a Triangle.(Chapter 11)

Unit- II
Straight Line: Introduction - Definitions of the Terms - Different Forms of the Equations of a Straight Line - Distance of a point from a Straight Line - Angle between two Lines and Condition of Parallelism and Perpendicularity of Lines - Point of intersection of Two Lines – Condition of Concurrency of Three Given Straight Lines - Position of a Point with respect to a given Line.(Chapter 13)

Unit- III
Matrices: Introduction - Definitions and Notations - Operations on Matrices - Determinant of a Square Matrix - Non Singular matrix and Singular Matrix - Sarrus Diagram for Expansion of Determinant of a matrix 3*X*3 - Properties of Determinants.(15.1,15.2,15.3,15.5.1,15.5.2,15.5.3 of Chapter 15)

Unit- IV
Linear System of Equations: Conversion of a business problem into a Linear System of Equations – Rank of a Matrix – Application of Rank concept – Minor and Cofactor – Adjoint of a Square matrix -Inverse of a Square Matrix – Matrix Equation – Methods to Solve Linear System of Equations – Solution to the linear system of Equations – Types of Solutions - Cramer" s rule - Matrix Inversion method. (15.4,15.5.4,15.5.5,15.5.6,15.5.7,15.5.8,15.6,15.7.1,15.7.2,15.7.3,15.7.4,15.7.4 of Chapter 15).

Text:

- P. Mariappan , *Business Mathematics*,Pearson Publication 2015, New Delhi.

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SEMESTER-V

1.14 Mathematics for Economics and Finance

Generic Elective - V(B) **BS:502(B)**

Theory: 4 credits and Tutorials: 0 credits
Theory: 4 hours /week and Tutorials: 1 hours /week

Objective: Many models and problems in modern economics and finance can be expressed using the language of mathematics and analysed using mathematical techniques. The aim is to show how a range of important mathematical techniques work and how they can be used to explore and understand the structure of economic models.

Outcome: Student were chiefly interested in learning the mathematics that had applications to economics and finance. Students gain a familiarity with economics and finance principles and are confident in applying them.

Unit- I
Linear Equations: Introduction – Solution of Linear Equations – Solutions of Simultaneous Linear Equations – Graphs of Linear Equations – Budget Lines – Supply and Demand Analysis . **Quadratic Equations:** Introduction – Graphys of Quadratic Functions – Quadratic Equations - Applications to Economics.

Unit- II
Functions of a Single Variable: Introduction – Limitis – Polynomial Functions – Reciprocal Functions – Inverse Functions. **The Exponential and Logarithmic Functions:** Introduction - Exponential Functions – Logarithmic Functions – Returns to Scale of Production Functions – Compounding of Interest.

Unit- III
Matrices and Determinants: Introduction – Matrix Operations – Solutions of Linear Systems of Equations – Cramer' s Rule – More Determinants – Special Cases.

Unit-IV
Linear Difference Equations: Introduction – Difference Equations – First Order Linear Difference Equations.

Text:

- Vassilis. C. Mavron and Timothy N.Phillips, *Elements of Mathematics for Economics and Finance*; Springer Publishers.

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SEMESTER-VI

1.15 Mathematical Modeling

Project/ Optional - VI **BS:602**

Theory: 4 credits and Tutorials: 0 credits
Theory: 4 hours /week and Tutorials: 1 hours /week

Objective: This topic is aims to provide the student with some basic modelling skills that will have application to a wide variety of problems.
Outcome: The focus is on those mathematical techniques that are applicable to models involving differential equations, and which describe rates of change. Student realizes some beautiful problems can be modeled by using differential equations. The students also learn how to use the mathematical technique in solving differential equations.

Unit- I
Introduction to Mathematical Modelling: Mathematical Models-Modelling for decision making. **Compartmental Models:**-Exponential decay and radioactivity – Case Study: Detecting art forgeries – Lake Pollution Models - First order Linear Differential Equations – Equilibrium points and stability.

Unit- II
Models of Single Populations: Exponential growth – Density-dependent growth – Limited growth with harvesting. **Interacting Population Models:** Model for an influenza outbreak – **Case Study:** Cholera – Predators and prey – Competing Species.

Unit- III
Formulating Heat and Mass Transporot Models: Some basic physical laws -Model for a hot water heater- Heat conduction and Fourier' s Law - Heat conduction through a wall – Radiative heat conoduction - Diffusion.

Unit- IV
Boundary Value Problems – Heat loss through a wall – Insulating a water pipe – **Introduction to Partial Differential Equations:** The heat conduction equation – Oscillating soil temperatures – **Case study:** Detecting Land Mines – Lake Pollution.

Text:

- 1. B.Barnes and G.R.Fulford, *Mathematical Modelling with Case Studies* 3rd Edition, 2009, CRC press.

References:

- 1. Shepley L. Ross, *"Differential Equations"*.
- 2. I. Sneddon , *Elements of Partial Differential Equations*
- 3.Zafar Ahsan, *"Differential Equations and their Applications"*

B.Sc/B.A Mathematics (Semester VI)
Project work

Theory : 4 Hours per week Credits : 4

- The total allotted marks 100 are divided into the following way

➢ **Internal Assessment (20 marks)**

- First seminar (10 marks – in between 25 to 30 days after commencement of class work). This seminar include the study of existing system, literature survey, problem definition.
- Second seminar (10 marks – in between 55 to 60 days after commencement of class work). This seminar include the requirements specification, analysis, design and partial implementation.

➢ **External Assessment (80 marks)**

- The students should submit one page of synopsis on the project work for display on the notice board.
- The project presentation is for 10 minutes followed by 05 minutes for discussion.
- The student should submit a dissertation/technical write-up on the project. At least two teachers will be associated with the project seminar to evaluate students for the award of seasonal marks which will be on the basis of performance in all the 3 items (synopsis, presentation, dissertation/technical write-up).

Dissertation	:	50 Marks
Presentation	:	15 Marks
Viva	:	15 Marks

Few Websites

- NPTEL: nptel.ac.in
- COURSERA: www.coursera.org
- MITOCW: ocw.mit.edu
- ACADEMIC EARTH: www.academicearth.org
- EdX : www.edx.org
- KHAN ACADEMY :www.khanacademy.org
- ALISON: www.alison.com
- STANFORD ONLINE: www.online.stanford.edu
- VIDEO LECTURES: videolectures.net
- INTERACTIVE REAL ANALYSIS: mathcs.org
- VISUAL CALCULUS: archives.math.utk.edu/visual.calculus
- MOOCS CALCULUS: mooculus.osu.edu

Few Math Softwares

- Useful for Classroom teaching: *Geogebra (Freeware)*
- Type setting software:*LaTeX*
- High end commercial softwares: *Mathematica , Maple , Matlab*
- Answering search engine: www.wolframalpha.com
- Group theory software: *group explorer 2.2 (Freeware)*
- Visualization software: *Mathematics Visualization Toolkit (freeware)*

B.A/B.Sc. I Year I Semester (CBCS) : Statistics Syllabus

(With Mathematics Combination)

(Examination at the end of Semester - I)

Paper – I : Descriptive Statistics and Probability

[4 HPW :: 4 Credits :: 100 Marks (External:80, Internal:20)]

Unit-I

Descriptive Statistics: Concept of primary and secondary data, Classification of data, Measures of central tendency (Arithmetic mean, median, mode, geometric mean and harmonic mean) with simple applications, Absolute and relative measures of dispersion (range, quartile deviation, mean deviation, standard deviation and variance) with simple applications.

Importance of moments, central and non-central moments, their inter-relationships, Sheppard's correction for moments for grouped data, Measures of skewness based on quartiles and moments, kurtosis based on moments with real life examples.

Unit-II

Probability: Basic concepts of probability, deterministic and random experiments, trial, outcome, sample space, event, operations of events, mutually exclusive and exhaustive events, equally likely and favorable events with examples, Mathematical, Statistical and Axiomatic definitions of probability, their merits and demerits. Properties of probability based on axiomatic definition.

Conditional probability and independence of events, Addition and multiplication theorems for 'n' events, Boole's inequality and Bayes' theorem, Problems on probability using counting methods and theorems.

Unit-III

Random Variables: Definition of random variable, discrete and continuous random variables, functions of random variables, probability mass function and probability density function with illustrations. Distribution function and its properties, Transformation of one-dimensional random variable (simple 1-1 functions only).

Notion of bivariate random variable, bivariate distribution, statements of its properties, Joint, marginal and conditional distributions, Independence of random variables.

Unit-IV

Mathematical Expectation: Mathematical expectation of a function of a random variable, Raw and central moments, covariance using mathematical expectation with examples, Addition and multiplication theorems of expectation. Chebyshev's and Cauchy-Schwartz's inequalities and their applications.

Definitions of moment generating function (m.g.f), characteristic function (c.f), cumulant generating function (c.g.f), probability generating function (p.g.f) and statements of their properties with applications.

Reference books:

1. **Fundamentals of Statistics, (Vol-I)** - Goon A M, Gupta M K, Das Gupta B, The World Press (Pvt) Ltd., Kolkata.

2. **Fundamentals of Mathematical Statistics** - V. K. Kapoor and S. C. Gupta, Sultan Chand & Sons, New Delhi.

Additional References:

1. Sanjay Arora and Bansilal: New Mathematical Statistics, Satya Prakashan , New Delhi.
2. William Feller: Introduction to Probability theory and its applications, (Vol-I), Wiley.
3. M. Jagan Mohan Rao and Papa Rao: A Text book of Statistics (Paper-I).
4. Hogg,Tanis, Rao: Probability and Statistical Inference, (7th edition), Pearson.
5. K.V.S. Sarma: Statistics Made Simple: Do it yourself on PC, PHI.
6. Gerald Keller: Applied Statistics with Microsoft Excel, Duxbury, Thomson Learning.
7. Levine, Stephen, Krehbiel, Berenson: Statistics for Managers using Microsoft Excel (4th edition), Pearson Publication.

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B.A/B.Sc. I Year I Semester (CBCS) : Statistics Syllabus

(With Mathematics Combination)
(Examination at the end of Semester - I)

Practical-1 : Descriptive Statistics and Probability

[3 HPW :: 1 Credit :: 50 Marks]

Part - 1 (Using Calculator)

1. Graphical presentation of data (Histogram, frequency polygon, Ogives) and its interpretation.
2. Diagrammatic presentation of data (Bar and Pie).
3. Computation of central tendency and dispersion measures for ungrouped and grouped data.
4. Computation of non-central and central moments – Sheppard's corrections for grouped data.
5. Computation of coefficients of Skewness - Karl Pearson's, Bowley's, β_1 and Kurtosis – β_2 and their interpretation.

Part - 2 (Using MS-Excel)

1. **Basics of Excel** - Data entry, editing and saving, establishing and copying formulae, Built in Functions - copy and paste, Find and Replace, Sorting.
2. **Basics of Excel** - Built in Functions - Filtering, Conditional formatting and creating Hyperlinks, Exporting to MS word document
3. Computation of descriptive Statistics using Pivote table - Univariate.
4. Data visualization through diagrams.
5. Computation of central tendency and dispersion measures, Coefficient of Variation for ungrouped and grouped data.
6. Computation of Coefficients of Skewness, Kurtosis using MS-Excel and interpretation.

Note : Training shall be on establishing formulae in Excel cells and deriving the results. The Excel output shall be exported to MSWord for writing inferences.

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B.A/B.Sc. I Year II Semester (CBCS) : Statistics Syllabus

(With Mathematics Combination)
(Examination at the end of Semester - II)

Paper – II : Probability Distributions

[4 HPW :: 4 Credits :: 100 Marks (External:80, Internal:20)]

Unit-I

Discrete distributions – I : Uniform and Bernoulli distributions : definitions, mean, variance and simple examples. Definition and derivation of probability mass functions of Binomial distribution, Poisson distribution, properties of these distributions: median, mode, m.g.f, c.g.f., p.g.f., c.f., and moments upto fourth order, reproductive property (wherever exists) and their real life applications. Poisson approximation to Binomial distribution.

Unit-II

Discrete distributions – II: Negative binomial, Geometric distributions: Definitions and real life applications, properties of these distributions: m.g.f, c.g.f., p.g.f., c.f. and moments upto fourth order, reproductive property (wherever exists), lack of memory property for Geometric distribution. Poisson approximation to Negative binomial distribution.
Hyper-geometric distribution: definition, real life applications, derivation of probability function, mean, variance. Binomial approximation to Hyper-geometric distribution.

Unit-III

Continuous distributions – I : Normal distributions – definition, properties such as m.g.f., c.g.f., c.f. and moments up to fourth order, reproductive property, wherever exists and their real life applications. Normal distribution as a limiting case of Binomial and Poisson distributions.

Unit-IV

Continuous distributions – II : Rectangular**,** Exponential, Gamma distributions - definition, properties: m.g.f., c.g.f., c.f. and moments up to fourth order, reproductive property (wherever exists) and their real life applications. Beta distribution of two kinds: Definitions, mean and variance.

Reference books:

3. **Fundamentals of Statistics, (Vol-I)** - Goon A M, Gupta M K, Das Gupta B, The World Press (Pvt) Ltd., Kolkata.

4. **Fundamentals of Mathematical Statistics** - V. K. Kapoor and S. C. Gupta, Sultan Chand & Sons, New Delhi.

Additional References:

8. Sanjay Arora and Bansilal: New Mathematical Statistics, Satya Prakashan , New Delhi.
9. William Feller: Introduction to Probability theory and its applications, (Vol-I), Wiley.
10. M. Jagan Mohan Rao and Papa Rao: A Text book of Statistics (Paper-I).
11. Hogg,Tanis, Rao: Probability and Statistical Inference, (7th edition), Pearson.
12. K.V.S. Sarma: Statistics Made Simple: Do it yourself on PC, PHI.
13. Gerald Keller: Applied Statistics with Microsoft Excel, Duxbury, Thomson Learning.
14. Levine, Stephen, Krehbiel, Berenson: Statistics for Managers using Microsoft Excel (4th edition), Pearson Publication.

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B.A/B.Sc. I Year II Semester (CBCS) : Statistics Syllabus

(With Mathematics Combination)
(Examination at the end of Semester - II)

Practical-2 : Probability Distributions

(3 HPW :: 1 Credit :: 50 Marks)

Part - 1 (Using Calculator)

1. Fitting of Binomial distribution-Direct method.
2. Fitting of Binomial distribution-Recurrence relation Method.
3. Fitting of Poisson distribution-Direct method
4. Fitting of Poisson distribution-Recurrence relation Method.
5. Fitting of Negative Binomial distribution.
6. Fitting of Geometric distribution.
7. Fitting of Normal distribution-Areas method.
8. Fitting of Normal distribution - Ordinates method.
9. Fitting of Exponential distribution.

Part - 2 (Using MS-Excel)

1. Data Visualization through graphs (Histogram, frequency polygon, Ogives) using MS-Excel and their interpretation.
2. Computation of descriptive Statistics using Pivote table – Bivariate.
3. Fitting of Binomial distribution-Direct method.
4. Fitting of Poisson distribution-Direct method.
5. Fitting of Normal distribution-Areas method.
6. Fitting of Exponential distribution.

Note : Training shall be on establishing formulae in Excel cells and deriving the results. The Excel output shall be exported to MSWord for writing inferences.

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B.A./B.Sc. (STATISTICS)

Theory Question Paper Pattern

(With Mathematics Combination)

Time : 3 hours] [Max. Marks : 80

Section - A

Answer any EIGHT questions. All questions carry equal marks. (8Qx4m=32)

1. From Unit I
2. From Unit I
3. From Unit I
4. From Unit II
5. From Unit II
6. From Unit II
7. From Unit III
8. From Unit III
9. From Unit III
10. From Unit IV
11. From Unit IV
12. From Unit IV

Section - B

Answer ALL questions. All questions carry equal marks. (4Qx12m=48)

13. a) From Unit I
    (or)
    b) From Unit I

14. a) From Unit II
    (or)
    b) From Unit II

15. a) From Unit III
    (or)
    b) From Unit III

16. a) From Unit IV
    (or)
    b) From Unit IV

B.A./B.Sc. (STATISTICS)

Practical Question Paper Pattern

(With Mathematics Combination)

Time: 3 hours] [Max. Marks: 50

Solve any THREE problems choosing at least one from each Section. (3Qx15m=45m) and Record: 5m

Section-A

1. From Part 1
2. From Part 1
3. From Part 1

Section - B

4. From Part 2
5. From Part 2

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B.A/B.Sc. II Year III Semester (CBCS) : Statistics Syllabus

(With Mathematics Combination)

(Examination at the end of Semester - III)

Paper – III : Statistical Methods and Theory of Estimation

[4 HPW :: 4 Credits :: 100 Marks (External:80, Internal:20)]

Unit –I

Bivariate data, Scattered diagram, Principle of least squares, fitting of straight line, quadratic and power curves. Concept of correlation, computation of Karl-Pearson correlation coefficient for grouped and ungrouped data and its properties.

Correlation ratio, Spearman's rank correlation coefficient and its properties. Simple linear regression, correlation verses regression, properties of regression coefficients.

Unit –II

Concepts of partial and multiple correlation coefficients (only for three variables). Analysis of categorical data, their independence, Association and partial association of attributes. Various measures of association: (Yule's) for two way data and coefficient of contingency (Pearson and Tcherprow) and coefficient of colligation**.**

Unit – III

Concepts of Population, Parameter, Random sample, Statistic, Sampling distribution and Standard error. Standard error of sample mean(s) and sample proportion(s). Exact sampling distributions - Statement and properties of χ^2, t and F distributions and their interrelationships. Independence of sample mean and variance in random sampling from normal distributions.

Point estimation of a parameter, concept of bias and mean square error of an estimate. Criteria of a good estimator- consistency, unbiasedness, efficiency and sufficiency with examples.

Unit – IV

Statement of Neyman's Factorization theorem, derivations of sufficient statistics in case of Binomial, Poisson, Normal and Exponential (one parameter only) distributions. Estimation by the method of moments, Maximum likelihood estimation (MLE), statements of asymptotic properties of MLE. Concept of interval estimation. Confidence intervals of the parameters of normal population by Pivot method.

Reference Books:

1. Goon AM, Gupta MK, Das Gupta B : Outlines of Statistics , Vol-II, the World Press Pvt. Ltd., Kolkata.

2. V. K. Kapoor and S. C. Gupta: Fundamentals of Mathematical Statistics, Sultan Chand & Sons, New Delhi

Additional References:

1. Hoel P.G : Introduction to Mathematical statistics, Asia Publishing house.
2. Sanjay Arora and Bansilal :.New Mathematical Statistics Satya Prakashan , New Delhi
3. Hogg and Craig : Introduction to Mathematical statistics. Prentice Hall
4. Siegal, S., and Sidney: Non-parametric statistics for Behavioral Science. McGraw Hill.
5. Gibbons J.D and Subhabrata Chakraborti : Nonparametric Statistical Inference. Marcel
   Dekker.
6. Parimal Mukhopadhyay : Mathematical Statistics. New Central Book agency.
7. Conover : Practical Nonparametric Statistics. Wiley series.
8. V. K. Rohatgi and A. K. Md. Ehsanes Saleh : An introduction to probability and statistics, Wiley series.
9. Mood A M, Graybill F A, Boe's DC. Introduction to theory of statistics. TMH
10. Paramiteya Mariyu Aparameteya Parikshalu. Telugu Academy.
11. K.V. S. Sarma: Statistics made simple do it yourself on PC. PHI
12. Gerald Keller : Applied Statistics with Microsoft excel. Duxbury. Thomson Learning
13. Levin, Stephan, Krehbiel, Berenson: Statistics for Managers using Microsoft Excel.4th Edition, Pearson Publication.
14. Hogg, Tanis, Rao. Probability and Statistical Inference.7th edition. Pearson Publication.
15. Milton and Arnold (fourth Edition):Introduction to Probability and Statistics, Tata McGraw Hill Publication.

B.A/B.Sc. II Year III Semester (CBCS): Statistics Syllabus

(With Mathematics Combination)

(Examination at the end of Semester - III)

Practical – *3 : Statistical Methods and Theory of Estimation*

(3 HPW, Credits 1 and Marks 50)

Part – A (Using Calculator)

1. Generation of random samples from Uniform (0,1), Uniform (a,b), Normal and Poisson and Exponential Distributions.
2. Fitting of straight line and parabola by the method of least squares.
3. Fitting of power curves of the type $y= a x^b$, $y=a b^x$ and $y=a e^{bx}$ by the method of least squares.
4. Computation of Yule's coefficient of association and Pearson's, Tcherprows coefficient of contingency.
5. Computation of correlation coefficient and regression lines for ungrouped data.
6. Computation of correlation coefficient, forming regression lines for ungrouped data.
7. Computation of correlation coefficient, forming regression lines for grouped data.
8. Computation of multiple and partial correlation coefficients.
9. Computation of correlation ratio

Part – B (Using Excel)

10. Simulation of random samples from Uniform (0,1), Uniform (a,b), Exponential, Normal and Poisson distributions using MS Excel.
11. Fitting of straight line and parabola by the method of least squares using MS Excel.
12. Fitting of power curves of the type $y= a x^b$, $y=a b^x$ and $y=a e^{bx}$ by the method of least squares using MS Excel.
13. Computation of correlation coefficient, forming regression lines using MS Excel.
14. Computation of multiple and partial correlation coefficients using MS Excel.

B.A/B.Sc. II Year III Semester (CBCS) : Statistics Syllabus

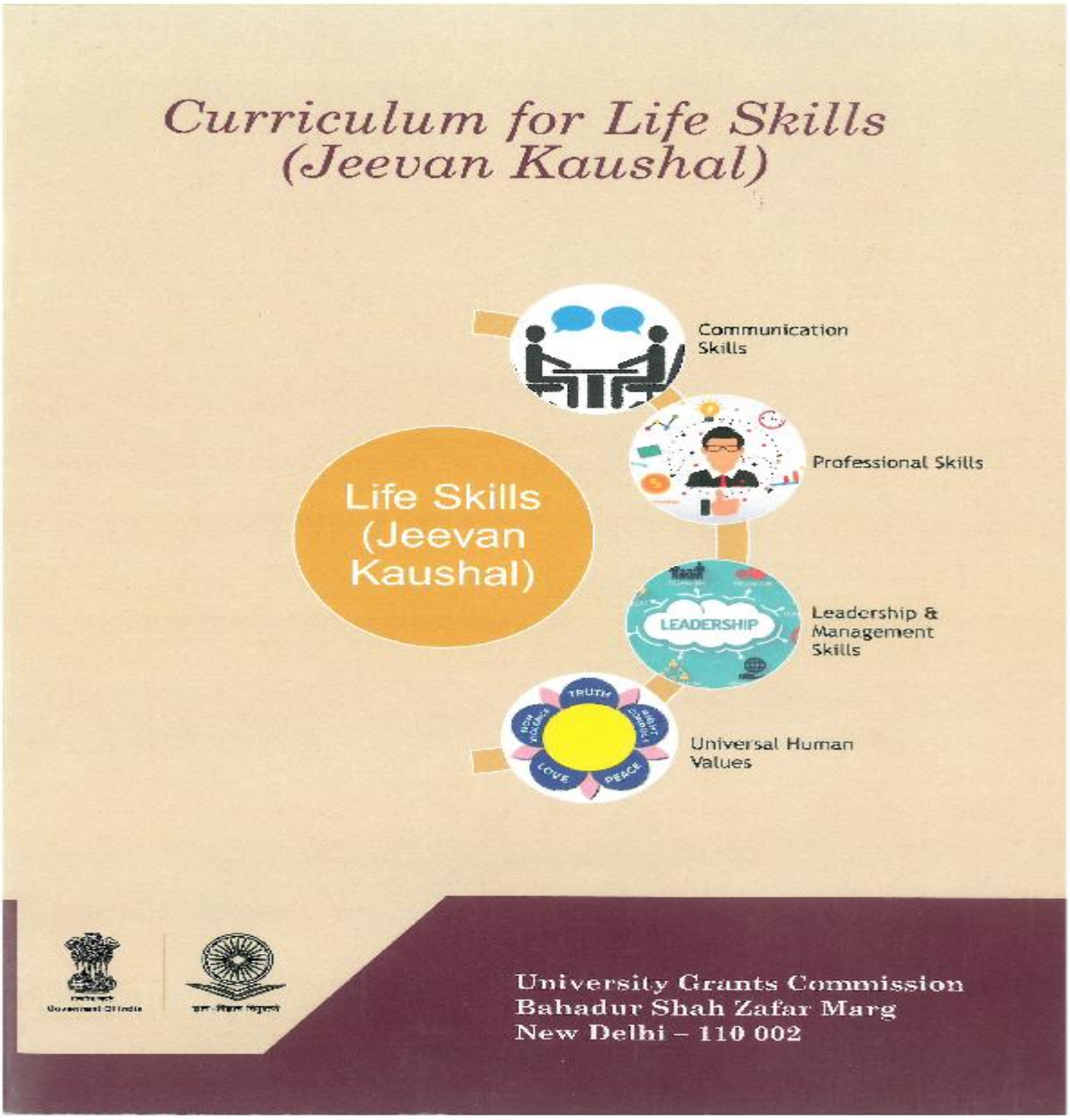
(With Mathematics Combination)

(Examination at the end of Semester - III)

SEC – 1 : UGC Specified Skill Enhancement Course

[2 HPW with 2 Credits and 50 Marks]

For Syllabus refer to



V

B.A/B.Sc. II Year III Semester (CBCS) : Statistics Syllabus

(With Mathematics Combination)

(Examination at the end of Semester - III)

SEC - 2 : Data Collection, Presentation and Interpretation

[2 HPW with 2 Credits and 50 Marks]

UNIT –I

Basic Concepts on Population, Sample, Sampling unit, Parameter, Statistic, Standard error, Sample Size and its Determination.

Steps in Sample design. Selecting the Problem and necessity of defining the Problem, Designing a questionnaire and a schedule for collecting data for a set of objectives under study with illustrated examples.

Methods for collecting Primary and Secondary data and their merits and demerits.

UNIT II

Graphical computation of Data and Interpretation : Histogram, frequency curve, frequency polygon, ogive curves.

Diagrammatic computation of Data and Interpretation : Bar diagrams (simple, component, multiple, percentage Bars), Pie diagram.

Classification and Tabulation of data. Data Interpretation techniques, Precaution in Interpretation. Data interpretation problems.

Reference Books :

1. Kotahri, C.R (2009): Research Methodology: Methods and Techniques, 2nd Revised Ed. Reprint, New Age International Publishers
2. S. P. Gupta : Statistical Methods.

B.A/B.Sc. II Year IV Semester (CBCS) : Statistics Syllabus

(With Mathematics Combination)

(Examination at the end of Semester - IV)

Paper - IV : Statistical Inference

[4 HPW :: 4 Credits :: 100 Marks (External:80, Internal:20)]

Unit–I

Concepts of statistical hypotheses, Null and Alternative hypothesis, Critical region, two types of errors, Level of significance and Power of a test. One and two tailed tests, test function (non-randomized and randomized). Statement and Proof of Neyman-Pearson's fundamental lemma for Randomized tests. Examples in case of Binomial, Poisson, Exponential and Normal distributions and their power of the test functions.

Unit-II

Large sample tests for single sample mean, difference of means, single sample proportion, difference of proportions and difference of standard deviations. Fisher's Z-transformation for population correlation coefficient(s**)** and testing the same in case of one sample and two samples**.** Definition of order statistics and statement of their distributions.

Unit – III

Tests of significance based on χ^2 - χ^2-test for specified variance, goodness of fit and test for independence of attributes (rxs, 2xk and 2x2 contingency tables). Tests of significance based on student's - t – t-test for single sample specified mean, difference of means for independent and related samples, sample correlation coefficient. F - test for equality of population variances.

Unit – IV

Non-parametric tests - their advantages and disadvantages, comparison with parametric tests. Measurement scale - nominal, ordinal, interval and ratio. Use of Central Limit Theorem in testing. One sample runs test, sign test and Wilcoxon-signed rank tests (single and paired samples). Two independent sample tests: Median test, Wilcoxon –Mann-Whitney U test, Wald Wolfowitz's runs test**.** Use of central limit theorem in testing.

Reference Books:

1. Goon AM, Gupta MK, Das Gupta B : Outlines of Statistics , Vol-II, the World Press Pvt. Ltd., Kolkata.
2. V. K. Kapoor and S. C. Gupta: Fundamentals of Mathematical Statistics, Sultan Chand & Sons, New Delhi

Additional References:

1. Hoel P.G : Introduction to Mathematical statistics, Asia Publishing house.
2. Sanjay Arora and Bansilal :.New Mathematical Statistics Satya Prakashan , New Delhi
3. Hogg and Craig : Introduction to Mathematical statistics. Prentice Hall
4. Siegal, S., and Sidney: Non-parametric statistics for Behavioral Science. McGraw Hill.
5. Gibbons J.D and Subhabrata Chakraborti : Nonparametric Statistical Inference. Marcel
   Dekker.
6. Parimal Mukhopadhyay : Mathematical Statistics. New Central Book agency.
7. Conover : Practical Nonparametric Statistics. Wiley series.
8. V. K. Rohatgi and A. K. Md. Ehsanes Saleh : An introduction to probability and statistics, Wiley series.
9. Mood A M, Graybill F A, Boe's DC. Introduction to theory of statistics. TMH
10. Paramiteya Mariyu Aparameteya Parikshalu. Telugu Academy.
11. K.V. S. Sarma: Statistics made simple do it yourself on PC. PHI
12. Gerald Keller : Applied Statistics with Microsoft excel. Duxbury. Thomson Learning
13. Levin, Stephan, Krehbiel, Berenson: Statistics for Managers using Microsoft Excel.4th Edition, Pearson Publication.
14. Hogg, Tanis, Rao. Probability and Statistical Inference.7th edition. Pearson Publication.
15. Milton and Arnold (fourth Edition):Introduction to Probability and Statistics, Tata McGraw Hill Publication.

B.A/B.Sc. II Year IV Semester (CBCS) : Statistics Syllabus

(With Mathematics Combination)
(Examination at the end of Semester - IV)

Practical – 4 : Statistical Inference

[3 HPW, Credits 1 and Marks 50]

Part – A (Using Calculator)

1. Large sample tests for mean(s), proportion(s), Standard deviation(s) and correlation coefficient.
2. Small sample tests for single mean and difference of means and correlation coefficient.
3. Paired t-test.
4. Small sample test for single and difference of variances.
5. $\chi 2$ – test for goodness of fit and independence of attributes.
6. Nonparametric tests for two independent samples (Median test,Wilcoxon Mann Whitney - U test, Wald - Wolfowitz's runs test)

Part – B (Using Excel)

7. Use of Look up and Reference functions for data analysis.
8. Creating and assigning Macros.
9. Small sample tests for mean(s), paired t-test and correlation coefficient using MS Excel.
10. Small sample test for single and difference of variances using MS Excel.
11. $\chi 2$ – test for goodness of fit and independence of attributes using MS Excel.
12. Nonparametric tests for single and related samples (sign test and Wilcoxon signed rank test) and one sample runs test.

Note : Training shall be on establishing formulae in Excel cells and deriving the results. The Excel output shall be exported to MSWord for writing inferences.

B.A/B.Sc. II Year IV Semester (CBCS): Statistics Syllabus

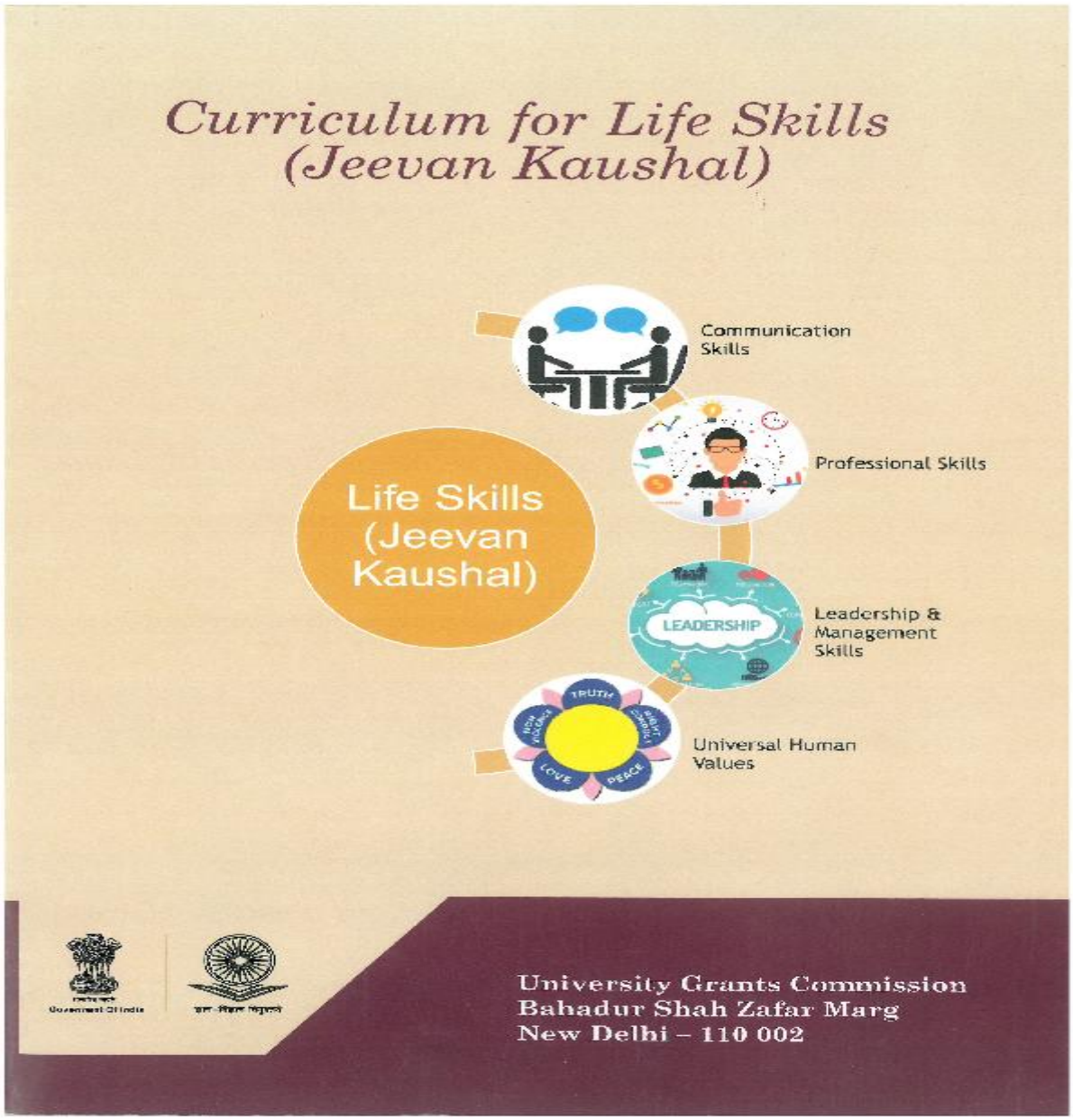
(With Mathematics Combination)

(Examination at the end of Semester - IV)

SEC – 3 - UGC Specified Skill Enhancement Course

[2 HPW with 2 Credits and 50 Marks]

For Syllabus refer to



B.A/B.Sc. II Year IV Semester (CBCS) : Statistics Syllabus

(With Mathematics Combination)

(Examination at the end of Semester - IV)

SEC - 4 : Data Scaling Techniques and Report writing

[2 HPW with 2 Credits and 50 Marks]

UNIT – I

Qualitative and Quantitative data, Measurement of Scales: nominal, ordinal, interval and ratio scales. Scale Classification Bases, Important Scaling Techniques, Scale Construction Techniques. Developing Likert-type Scales, Factor scales and Cumulative Scales their advantages and limitations.

UNIT-II

Interpretation and Report Writing: meaning of interpretation, technique of interpretation, precautions in interpretation, significance of report writing, different steps in writing report. layout of the research report, types of reports, oral presentation, mechanics of writing a research report.

Reference Books :

1. SC Gupta and VK Kapoor : Fundamentals of Applied Statistics, Sultan Chand & Sons
2. Goon AM, Gupta MK, Das Gupta B : Fundamentals of Statistics , Vol-I, The World Press Pvt. Ltd., Kolkata.

B.A/B.Sc. III Year V Semester (CBCS): Statistics Syllabus

(With Mathematics Combination)

(Examination at the end of III Year V Semester)

Paper-V: Sampling Theory, Time series, Index Numbers and Demand Analysis

(DSC-2E)

(3 Hours Per Week with 3 Credits and 75 Marks)

UNIT-I

Sample Surveys: Concepts of population, sample, sampling unit, parameter, statistic, sample frame and standard error. Principal steps in sample surveys - need for sampling, census versus sample surveys, sampling and non- sampling errors, sources and treatment of non-sampling errors, advantages and limitations of sampling.

Sampling Methods: Types of sampling: Subjective, probability and mixed sampling methods. Methods of drawing random samples with and without replacement. Estimates of population mean, total, and proportion, their variances and the estimates of variances in Simple Random Sampling With and Without Replacement.

UNIT-II

Estimates of population mean, total, and proportion, their variances and the estimates of variances in the following methods.

(i) Stratified Random Sampling with Proportional and Neyman allocation, and

(ii) Systematic Sampling when N= nk.

Comparison of relative efficiencies. Advantages and disadvantages of SRS, Stratified and Systematic sampling methods.

Time series: Time series and its components with illustrations, additive, multiplicative and mixed models. Determination of trend by least squares and moving average methods. Growth curves and their fitting with reference to Modified exponential, Gompertz and Logistic curves. Determination of seasonal indices by Ratio to moving average, ratio to trend and link relative methods.

UNIT-III

Demand Analysis: Introduction. Demand and supply, price elasticity of supply and demand. Methods of determining demand and supply curves, Leontief's ,Pigous's methods of determining demand curve from time series data, limitations of these methods Pigou's method from time series data. Pareto law of income distribution curves of concentration.

Index Numbers: Concept, construction, uses and limitations of simple and weighted index numbers. Laspeyer's, Paasche's and Fisher's index numbers, criterion of a good index numbers, problems involved in the construction of index numbers. Fisher's index as an ideal index number. Fixed and chain base index numbers. Cost of living index numbers and wholesale price index numbers. Base shifting, splicing and deflation of index numbers.

Reference Books:

1. V.K. Kapoor and S.C. Gupta : Fundamentals of Applied Statistics. Sultan Chand
2. Parimal Mukhopadhyay : Applied Statistics, New Central Book agency.
3. Daroga Singh and Chowdhary: Theory and Analysis of Sample survey designs. Wiley Eastern.
4. M.R.Saluja : Indian Official Statistics. ISI publications.
5. B.L.Agarwal: Basic Statistics.New Age publications.
6. S.P.Gupta : Statistical Methods. Sultan Chand and Sons.
7. Anuvartita Sankhyaka Sastram – Telugu Academy.
8. Arora, SumeetArora,S.Arora: Comprehensive Statistical Methods. S.Chand.
9. A.M.Goon, M.K.Gupta, B. Dasgupta: Fundamentals of Statistics Vol II World Press Private Ltd.,Calcutta
10. A.M.Goon,M.K.Gupta,B.Dasgupta An outline of Statistical Theory Vol II World Press Private Ltd.,Calcutta17.

Note: Theory paper is for 60 Marks and Internal is 15 Marks

B.A/B.Sc. III Year V Semester (CBCS): Statistics Syllabus

(With Mathematics Combination)

(Examination at the end of III Year V Semester)

Paper-VI A: Statistical Quality Control and Reliability (DSE-2E)

(3 Hours Per Week with 3 Credits and 75 Marks)

Unit –I

Statistical Quality Control: *Importance of SQC in industry. Dimensions of quality, Statistical basis of Shewart control charts. Construction of control charts for variables (mean, range and standard deviation) and attributes (p , np with fixed and varying sample sizes) and their Interpretation.*

Unit –II

Control charts for attributes (c and u charts with fixed and varying sample sizes) and their Interpretation. Construction of control charts for Natural tolerance limits and specification limits, process capability index and modified control charts.

Unit –III

Acceptance sampling plans:. Concept of AQL and LTPD. Producers risk and consumer's risk Single and Double sampling plans for attributes and their OC and ASN functions. Design of single and double sampling plans for attributes using Binomial and Poisson distributions. Construction of OC and ASN functions.

Reliability: Introduction. Hazard function, Exponential distribution as life model, its memory- less property. Reliability function and its estimation.

System reliability - series, parallel and k out of N systems and their reliabilities with simple examples.

Reference Books:

1. D.C. Montgomary: Introduction to Statistical Quality Control. Wiley
2. V.K. Kapoor and S.C.Gupta L Fundamentals of Applied Statistics. Sultan Chand
3. Parimal Mukhopadhyay : Applied Statistics . New Central Book agency
4. Anuvartita Sankhyakasastram – Telugu Academy.
5. R.C.Gupta: Statistical Quality Control.
6. S.K.Sinha: Reliability and life testing. Wiley Eastern
7. L.S.Srinath: Reliability Engineering. Affiliated East-West Press.

Note: Theory paper is for 60 Marks and Internal is 15 Marks

B.A/B.Sc. III Year V Semester (CBCS): Statistics Syllabus

(With Mathematics Combination)

(Examination at the end of III Year V Semester)

Paper-VI B: Bio-Statistics - I (DSE-2E)

(3 HPW with 3 Credits and 75 Marks)

Unit –I

Bioassay : The purpose and structure of biological assay. Types of biological assays, Direct assays, Ratio estimates, asymptotic distributions: Feller's theorem. Regression approach to estimate dose – response and relationships.

Unit –II

Logit and Probit approaches when dose-response curve for standard preparation is unknown, quantal responses, methods of estimation of parameters, estimation of extreme quantiles, dose allocation schemes, polychotomous quantal response, estimation of points on the quantal response function**.**

Unit –III

Statistical Genetics: Basic terminology of genetics.Frequencies of genes and genotypes, Mendal's law, Hardy-Weinberg equilibrium. Mating Frequencies, estimation of allele frequency (dominant / codominant cases). Multiple alleles.

Approach to equilibrium for X-linked gene, natural selection, mutation, genetic drift, equilibrium when both natural selection and mutation are operative**.**

Reference Books:

1. D.J.Finney (1970): Statistical methods in Biological Assay. Charles Griffin.
2. Govindarajulu (2000): Statistical Techniques in Bioassay. Karger Publishers/Panther Publishers.
3. C.C.Li (1976): First course in population genetics. Boxwood press, California.
4. Falcon and Mackay (1998) : Introduction to quantitative genetics. Longman
5. J.F.Lawless: Statistical models and methods of life data. Wiley.
6. James F Crow and Motoo Kimura: An Introduction to Population Genetics Theory. Alpha edition.

Note: Theory paper is for 60 Marks and Internal is 15 Marks

B.A/B.Sc. III Year V Semester (CBCS): Statistics Syllabus

(With Mathematics Combination)

(Examination at the end of III Year V Semester)

Paper-VI C: Actuarial Statistics - I (DSE-2E)

(3 HPW with 3 Credits and 75 Marks)

Unit –I

Utility theory, insurance and utility theory, models for individual claims and their sums, survival function, curate future lifetime, force of mortality.

Unit –II

Life table and its relation with survival function examples, assumptions of fractional ages, some analytical laws of mortality select and ultimate tables**.**

Multiple life functions, joint life and last survivor status, insurance and annuity benefits through multiple life functions, evaluation for special mortality laws.

Unit –III

Multiple decrement models, deterministic and random survivorship groups, associated single decrement tables, central rates of multiple decrement, net single premiums and their numerical evaluations.
Distribution of aggregate claims, compound Poisson distribution and its applications.

Reference Books:

1. N.L.Bowers, H.U.Gerber, J.C.Hickman, D.A.Jones and C.J.Nesbitt (1986): Actuarial Mathematics, Society of Actuaries, Ithaca, Illinois,USA .
2. Neill,A.(1977): Life contingencies, Heineman.
3. Spurgeon E.T.(1972): Life contingencies, Cambridge University Press
4. Benjamin,B and Pollard,J.H(1980): Analysis of Mortality and other Actuarial Statistics.
5. Federation of Insurance Institutes study courses: mathematical basis of Life Assurance (Published by Federation if Insurance Institutes, Bombay).

Note: Theory paper is for 60 Marks and Internal is 15 Marks

B.A/B.Sc. III Year V Semester (CBCS): Statistics Syllabus

(With Mathematics Combination)
(Examination at the end of III Year V Semester)
Practical Paper-V: Theory Paper V and Elective VI A
(with 2 HPW, Credits 1 and 25 Marks)

Section – A

1. Estimation of Population mean, population total and variance of these estimates by Simple random sampling with and without replacement. Comparison between SRSWR and SRSWOR
2. Stratified random sampling with proportional and optimum allocations. Comparison between proportional and optimum allocations with SRSWOR
3. Systematic sampling with N = nk. Comparison of Systematic sampling with Stratified and SRSWOR
4. Measurement of trend by method of least squares and moving averages.
5. Determination of seasonal indices by the method of Ratio to moving averages.
6. Determination of seasonal indices by the method of Ratio to trend.
7. Determination of seasonal indices by the method of link Relatives.

Section – B

8. Construction of $\overline{X}$, **R** and σ - charts.
9. Construction of p, np, charts with fixed and varying n.
10. Construction of c and u charts.
11. Designing a single sampling plan and construction of its OC and ASN curves.
12. Designing a double sampling plan and construction of its OC and ASN curves.

Note: The question paper consists of TWO sections. Section A Consists of 2 Questions From Section A of Practical paper V and Section B consists of 2 questions from Section B of Practical paper V.

B.A/B.Sc. III Year V Semester (CBCS): Statistics Syllabus

(With Mathematics Combination)
(Examination at the end of III Year V Semester)
Practical Paper-V: Theory Paper V and Elective VI B
(with 2 HPW, Credits 1 and 25 Marks)

Section – A

1. Estimation of Population mean, population total and variance of these estimates by Simple random sampling with and without replacement. Comparison between SRSWR and SRSWOR
2. Stratified random sampling with proportional and optimum allocations. Comparison between proportional and optimum allocations with SRSWOR
3. Systematic sampling with N = nk. Comparison of Systematic sampling with Stratified and SRSWOR
4. Measurement of trend by method of least squares and moving averages.
5. Determination of seasonal indices by the method of Ratio to moving averages.
6. Determination of seasonal indices by the method of Ratio to trend.
7. Determination of seasonal indices by the method of link Relatives.

Section – B

8. Fitting of exponential growth model to data by linearization method.
9. Fitting of logistic growth model.
10. Dose response relation and its estimation by least squares method and by MLE method.
11. Estimation of extreme quantiles and points on the quantal response .
12. Hardy –Weinberg equilibrium frequencies and Estimation of allele frequencies.
13. Effects of mutation and selection and the Hardy -Weinberg test.
14. Equilibrium—Balance between selection and mutation.

Note : The question paper consists of TWO sections. Section A Consists of 2 Questions from Section A of Practical paper V and Section B consists of 2 questions from Section B of Practical paper V.

B.A/B.Sc. III Year V Semester (CBCS): Statistics Syllabus

(With Mathematics Combination)
(Examination at the end of III Year V Semester)
Practical Paper-V: Theory Paper V and Elective VI C
(with 2 HPW, Credits 1 and 25 Marks)

Section – A

1. Estimation of Population mean, population total and variance of these estimates by Simple random sampling with and without replacement. Comparison between SRSWR and SRSWOR
2. Stratified random sampling with proportional and optimum allocations. Comparison between proportional and optimum allocations with SRSWOR
3. Systematic sampling with N = nk. Comparison of Systematic sampling with Stratified and SRSWOR
4. Measurement of trend by method of least squares and moving averages.
5. Determination of seasonal indices by the method of Ratio to moving averages.
6. Determination of seasonal indices by the method of Ratio to trend.
7. Determination of seasonal indices by the method of link Relatives.

Section – B

8. Computation of values of utility function.
9. Computation of various components of life tables.
10. Construction of multiple decrement table for deterministic survival group.
11. Determination of distribution function, survival function and force of mortality.
12. Construction of multiple decrement table for random survivorship group.
13. Construction of select, ultimate and aggregate mortality.
14. Calculation of p.d.f. and distribution function of aggregate claims.

Note : The question paper consists of TWO sections. Section A Consists of 2 Questions from Section A of Practical paper V and Section B consists of 2 questions from Section B of Practical paper V.

B.A/B.Sc. III Year V Semester (CBCS): Statistics Syllabus

(With Mathematics Combination)
(Examination at the end of III Year V Semester)
Practical Paper-VI: MS - EXCEL
(with 2 HPW, Credits 1 and 25 Marks)

Time Series Analysis

1. Measurement of trend by method of least squares and moving averages.
2. Determination of seasonal indices by the method of Ratio to moving averages.
3. Determination of seasonal indices by the method of Ratio to trend.
4. Determination of seasonal indices by the method of link Relatives.

Index Numbers

5. Base shifting, splicing and Deflation.

Statistical Quality Control

6 Construction of $\bar{x}$, **R** and σ- charts.
7 Construction of p and np charts with fixed n.
8 Construction of p and np charts with varying n.
9 Construction of c and u charts.

Demand Analysis

10 Construction of Lorenz curve.
11 Fitting of Pareto law to an income data.

Note 1 : Training shall be on establishing formulae in Excel cells and deriving the results. The Excel output shall be exported to MSWord for writing inferences.

Note 2 : The question paper consists of TWO sections. Section A Consists of 2 Questions from Paper VI Practical and Section B consists of 2 questions on MS – Excel from Semesters I and III respectively.

B.A/B.Sc. III Year VI Semester (CBCS): Statistics Syllabus
(With Mathematics Combination)
(Examination at the end of III Year V Semester)
SEC-3: Big Data Analysis
(2 HPW with 2 Credits and 50 Marks)

UNIT I

The Rise of Big Data: What is Big Data and why does it matter; Web Data: The original Big Data; The cross section of Big Data and the value they hold;

UNIT II

Taming Big Data: The Technologies, Process and Methods: The Evolution of Analytic Scalability, The Evolution of Analytic Process, The Evolution of Analytic Tools and Methods.

Text Book:

1. Bill Franks, "Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics", John Wiley & sons, 2012. (Chapters 1 to 6).

Reference Books:

1. Michael Berthold, David J. Hand, "Intelligent Data Analysis", Springer, 2007.
2. Glenn J. Myatt, "Making Sense of Data", John Wiley & Sons, 2007
3. Pete Warden, "Big Data Glossary", O'Reilly, 2011.

Note: Theory paper is for 40 Marks and Internal is 10 Marks

B.A/B.Sc. III Year: Statistics Syllabus
(Generic Elective-GE-1)
(Examination at the end of III Year, Semester V)
GE – 1 –Basic Statistics-1(with 2 HPW, Credits 2 and Marks 50).

Unit – I

Origin, Importance and growth of Statistics, Collection and tabulation of data.Frequency distribution. Graphical and Pictorial representation of data. Measures of central tendency: Mean, Median and Mode their merits and demerits with examples. Partition Values: Quartiles, Deciles and percentiles and examples.
Measures of dispersion: Range and standard deviation, coefficient of variation. Central and non-Central moments, coefficient of Skewness and Kurtosis, Examples.

Unit – II

Review of permutations and combinations. Deterministic and random experiment, Sample space, event mutually exclusive, equally likely and independent events with examples. Mathematical, Statistical and axiomatic definition of probability, Addition theorem, conditional probability and multiplication theorem of probability. Statistical independence and Bayes theorem –simple examples (all theorems without proofs and only statements).

List of reference books:

1. V.K.Kapoor and S.C.Gupta: Fundamentals of Mathematical Statistics, Sultan Chand & Sons, New Delhi
2. GoonAM,GuptaMK,Das Gupta B : Fundamentals of Statistics , Vol-I, the World Press Pvt.Ltd., Kolakota.
3. Charles M.Grinstead and Laurie Snell, J: Introduction to Probability, American Mathematical Society

Note: Theory paper is for 40 Marks and Internal is 10 Marks

B.A/B.Sc. III Year VI Semester (CBCS): Statistics Syllabus

(With Mathematics Combination)
(Examination at the end of III Year VI Semester)
Paper-VII: Design of Experiments, Vital Statistics, Official Statistics and Business Forecasting (DSC-2F)
(3 HPW with 3 Credits and 75 Marks)

Unit –I

Analysis of Variance and Design of Experiments : *Concept of Gauss-Markoff linear model with examples, statement of Cochran's theorem, ANOVA – one-way, two-way classifications with one observation per cell Expectation of various sums of squares, Statistical l analysis, Importance and applications of design of experiments.*

Principles of experimentation: *Analysis of Completely randomized Design (C.R.D), Randomized Block Design (R.B.D)*

Unit –II

Latin Square Design (L.S.D) including one missing observation, expectation of various sum of squares. Comparison of the efficiencies of above designs.

Official Statistics: Functions and organization of CSO and NSSO. Agricultural Statistics, area and yield statistics. National Income and its computation, utility and difficulties in the estimation of national income.

Business Forecasting: Role of forecasting in Business, Steps in Forecasting, Methods of Forecasting, Choice of a method of Forecasting, Theories of Business Forecasting, Cautions while using Forecasting Techniques.

Unit – III

Vital statistics: Introduction, definition and uses of vital statistics. Sources of vital statistics, registration method and census method. Rates and ratios, Crude death rates, age specific death rate, standardized death rates, crude birth rate, age specific fertility rate, general fertility rate, total fertility rate. Measurement of population growth, crude rate of natural increase- Pearl's vital index. Gross reproductive rate sand Net reproductive rate, Life tables, construction and uses of life tables and Abridged life tables.

Reference Books:

1. V.K.Kapoor and S.C.Gupta : Fundamentals of Applied Statistics. Sultan Chand
2. ParimalMukhopadhyay : Applied Statistics . New Central Book agency.
3. M.R.Saluja : Indian Official Statistics. ISI publications.
4. B.L.Agarwal: Basic Statistics. New Age publications.
5. S.P.Gupta : Statistical Methods. Sultan Chand and Sons.
6. Pratirupa Sidhanthamulu – Telugu Academy. Prayoga Rachana and Visleshana – Telugu Academy.

Note: Theory paper is for 60 Marks and Internal is 15 Marks

B.A/B.Sc. III Year VI Semester (CBCS): Statistics Syllabus

(With Mathematics Combination)

(Examination at the end of III Year VI Semester)

Paper-VIII A: Operations Research (DSE-2F)

(3 Hours Per Week with 3 Credits and 75 Marks)

Unit –I

Operations Research: Meaning and scope of OR. Convex sets and their properties. Definition of general LPP. Formulation of LPP. Solution of LPP by graphical method. Statements of Fundamental theorem of LPP and other related theorems. Simplex algorithm.

Concept of artificial variables. Big –M /Penalty method and two-phase simplex methods. Concept of degeneracy and resolving it.

Unit –II

Concept of duality of LPP. Dual Primal relationship, Statement of Fundamental Theorem of Duality.

Definition of transportation problem, TPP as a special case of LPP, Initial basic feasible solutions by North-West Corner Rule, Matrix minimum method and VAM. Optimal solution through MODI tableau and stepping stone method for balanced and unbalanced transportation problem.

Unit –III

Degeneracy in TP and resolving it. Concept of Transshipment problem.

Formulation and description of Assignment problem and its variations. Assignment problem as special case of TP and LPP. Unbalanced assignment problem, optimal solution using Hungarian method and traveling salesman problem and its solution.

Problem of Sequencing. Optimal sequence of N jobs on two and three machines without passing.

Reference Books:

1. Kanti Swaroop, P.K.Gupta and ManMohan: Operations Research. Sultan Chand.
2. S.D. Sharma: Operations Research
3. J.K. Sharma: Operations Research Theory and Applications. Macmillan Publishers India LTD.
4. Parikriya Parishodhana - Telugu Academy.

Note: Theory paper is for 60 Marks and Internal is 15 Marks

B.A/B.Sc. III Year VI Semester (CBCS): Statistics Syllabus

(With Mathematics Combination)

(Examination at the end of III Year VI Semester)

Paper-VIII B: Bio-Statistics - II (DSE-2F)

(3 HPW with 3 Credits and 75 Marks)

Unit –I

Survival Analysis: Survival functions and hazard rates. Types of censoring and likelihood in these cases. Life distributions - Exponential, Gamma, Weibull, Lognormal, and Pareto. Linear failure rate. Point estimation, confidence intervals, scores, likelihood ratio, MLE, tests for these distributions.

Unit –II

Life tables, failure rates, mean residual life and their elementary properties, Ageing classes and their properties, Bathtub failure rate. Estimation of survival function.
Acturial estimator, Kaplan-Meier estimator, estimation under the assumption of IFR/ DFR. Tests of exponentiality against nonparametric classes, total time on test.

Unit –III

Introduction to modern epidemiology, principles of epidemiological investigation, serveillance and disease monitoring in populations.
Epidemiologic measures: Organizing and presenting epidemiologic data, measures of disease frequency, measures of effect and association, causation and casual inference.

Design and analysis of epidemiologic studies. Types of studies, case-control studies, cohort studies, cross over design, regression models for the estimation of relative risk.
Meta –analysis, quantitative methods in screening.

Reference Books:

1. Cox.D.R. and Oakes.D (1984): analysis of survival data. Chapman and Hall.
2. Miller, R.G. (12981): Survival analysis. John wiley.
3. Anil gore and S.A.Paranjpe (2000). A course in mathematical and statistical ecology. Kulwer Academic Publishers.
4. Rielon E.C (1977): An introduction to Mathematical Ecology. Wiley.
5. J.F.Lawless: Statistical models and methods of life data. Wiley.
6. James F Crow and Motoo Kimura: An Introduction to Population Genetics Theory. Alpha edition.
7. Abraham M.Lilienfeld : Foundations of Epidemiology. Oxford University Press.

Note: Theory paper is for 60 Marks and Internal is 15 Marks

B.A/B.Sc. III Year VI Semester (CBCS): Statistics Syllabus

(With Mathematics Combination)

(Examination at the end of III Year VI Semester)

Paper-VIII C: Actuarial Statistics - II (DSE-2F)

(3 HPW with 3 Credits and 75 Marks)

Unit –I

Elements of compound interest (nominal and effective rate of interest)
Life annuities: single payment, continuous life annuities, discrete life annuities, life annuities with monthly payments, communication functions.

Unit –II

Varying Life annuities, recursions and complete annuities- immediate and apportioable annuities –due.
Net premiums: Continuous and discrete premiums, true monthly payment premiums, apportionate premiums, commutation functions, and accumulation type benefits.

Unit –III

Net premium reserves: continuous and discrete net premium reserve, reserves on a semi continuous basis, reserves based on true monthly premiums, reserves on an apportionable or accounted continuous basis reserves at fractional durations.

Reference Books:

1. N.L.Bowers, H.U.Gerber, J.C.Hickman, D.A.Jones and C.J.Nesbitt (1986): Actuarial Mathematics, Society of Actuaries, Ithaca, Illinois,USA .
2. Neill,A.(1977): Life contingencies, Heineman.
3. Spurgeon E.T.(1972): Life contingencies, Cambridge University Press
4. Benjamin,B and Pollard,J.H(1980): Analysis of Mortality and other Actuarial Statistics.
5. Federation of Insurance Institutes study courses: mathematical basis of Life Assurance
8. F.I.21 (Published by Federation if Insurance Institutes, Bombay).

Note: Theory paper is for 60 Marks and Internal is 15 Marks

B.A/B.Sc. III Year VI Semester (CBCS): Statistics Syllabus

(With Mathematics Combination)
(Examination at the end of III Year VI Semester)
Practical Paper-VII: Theory Paper VII and Elective VIII A (DSC-2F)
(with 2 HPW, Credits 1 and Marks 25)

Section –A

1. Analysis of CRD
2. Analysis of RBD and Comparison of RBD with CRD with and without missing observation.
3. Analysis of RBD with one missing observation and computation of Critical Difference.
4. Analysis of LSD and Comparison of LSD with RBD with CRD.
5. Analysis of LSD with one missing observation and computation of Critical Difference.
6. Computation of Morality rates and Fertility rates and Construction of complete life tables.

Section –B

7. Solution of L.P. problem by simplex method and reading the solution of the dual problem from Optimal Simplex table.
8. Solution of L.P. problem by Big-M Method.
9. Two-phase simplex method.
10. IBFS for a transportation problem by North-West corner rule, Matrix minimum method and Vogel's approximation method and also Optimum solution to balanced and unbalanced transportation problem by MODI method.
11. Optimum solution to balanced and unbalanced Assignment problem by Hungarian method and also Solution of traveling salesman problem.
12. Computation of Optimal Sequence and idle time for N jobs on 2 and 3 machines.

Note: The question paper consists of TWO sections. Section A Consists of 2 Questions from Section A of Practical paper VII and Section B consists of 2 questions from Section B of Practical paper VII.

B.A/B.Sc. III Year VI Semester (CBCS): Statistics Syllabus

(With Mathematics Combination)

(Examination at the end of III Year VI Semester)

Practical Paper-VII: Theory Paper VII and Elective VIII B (DSC-2F)

(with 2 HPW, Credits 1 and Marks 25)

Section –A

1. Analysis of CRD
2. Analysis of RBD and Comparison of RBD with CRD with and without missing observation.
3. Analysis of RBD with one missing observation and computation of Critical Difference.
4. Analysis of LSD and Comparison of LSD with RBD with CRD.
5. Analysis of LSD with one missing observation and computation of Critical Difference.
6. Computation of Morality rates and Fertility rates and Construction of complete life tables.

Section –B

7. Parameter estimation in exponential and Weibull distributions—Type-I, Type-II censoring.
8. LR tests for exponential and Weibull distribution.
9. Actuarial method of estimation.
10. Kaplan-Meier estimator.
11. Fitting bathtub shaped hazard function.
12. Risk difference, risk ratio and odd ratio.
13. Cox Regression.

Note: The question paper consists of TWO sections. Section A Consists of 2 Questions from Section A of Practical paper VII and Section B consists of 2 questions from Section B of Practical paper VII.

B.A/B.Sc. III Year VI Semester (CBCS): Statistics Syllabus

(With Mathematics Combination)
(Examination at the end of III Year VI Semester)
Practical Paper-VII: Theory Paper VII and Elective VIII C (DSC-2F)
(with 2 HPW, Credits 1 and Marks 25)

Section –A

1. Analysis of CRD
2. Analysis of RBD and Comparison of RBD with CRD with and without missing observation.
3. Analysis of RBD with one missing observation and computation of Critical Difference.
4. Analysis of LSD and Comparison of LSD with RBD with CRD.
5. Analysis of LSD with one missing observation and computation of Critical Difference.
6. Computation of Morality rates and Fertility rates and Construction of complete life tables.

Section –B

7. Computation of compound interest (nominal and effective rate of interests).
8. Annuities and annuity dues.
9. Computation of discrete and continuous net premiums.
10. Annuities payable more frequently than one year.
11. Complete and special annuities.
12. Office premium
13. Assurances payable at the moment of death.

Note: The question paper consists of TWO sections. Section A Consists of 2 Questions from Section A of Practical paper VII and Section B consists of 2 questions from Section B of Practical paper VII.

B.A/B.Sc. III Year VI Semester (CBCS): Statistics Syllabus

(With Mathematics Combination)
(Examination at the end of III Year VI Semester)
Practical Paper-VIII: (Practical using MS-Excel and TORA) (DSC-2F)
(with 2 HPW, Credits 1 and Marks 25)

Operations Research:

1 Solution of L.P. problem by Graphical method.

2 Solution of L.P. problem by simplex method.

3 Solution of L.P. problem by Big-M and two-phase simplex method.

4 Optimum solution to balanced and unbalanced transportation problem using North-West corner rule, Matrix minimum method and Vogel's approximation method for IBFS.

5 Solution of Assignment problem for both maximization and minimization

6 Solution of travelling salesman problem.

7 Computation of Optimal Sequence and idle time for N jobs on 2 and 3 machines.

Designs of Experiments

8. Analysis of CRD

9. Analysis of RBD with and without missing observation. Comparison of RBD with CRD

10. Analysis of LSD with and without missing observation. Comparison of LSD with RBD and CRD

Vital Statistics

11. Computation of Morality rates, Fertility rates and Reproduction rates.

12. Construction of life tables and abridged life tables.

Note 1 : Training shall be on establishing formulae in Excel cells and deriving the results. The excel output shall be exported to MSWord for writing inferences.

Note 2 : The question paper consists of TWO sections. Section A Consists of 2 Questions from Paper VIII Practical and Section B consists of 2 questions on MS – Excel from Semesters II and IV respectively.

B.A/B.Sc. III Year VI Semester (CBCS): Statistics Syllabus (With Mathematics Combination) (Examination at the end of III Year VI Semester) SEC-4: Statistical Techniques in Data Mining (2 HPW with 2 Credits and 50 Marks)

UNIT-I

Introduction: Introduction to Data mining, The nature of Data sets, Types of structure, Models and patterns, Data mining Tasks, components of data mining algorithms, The Interacting roles of Statistics and Data mining, Data mining: Dredging, snooping and fishing.
Data mining: Definitions, KDD vs Data mining, DBMS vs DM, other related areas, DM Techniques, other mining problems, Issues and challenges in Data mining,
Association Rules: What is an association rule, methods to discover association rules; Apriori Algorithm, Partition Algorithm

UNIT-II

Association Algorithms: Dynamic Item Set Counting Algorithm, FP Tree growth algorithm.
Clustering Algorithms: Introduction, Clustering Paradigm, K-Medoid Algorithm, DBSCAN
Classification Algorithms: Introduction, Nearest Neighbor methods
Decision tree Algorithms: Introduction, Pruning technique.

Reference Books:

1. David Hand, Heikki Manila and Padhraic Smyth (2012): Principles of Data Mining, PHI, New Delhi, (Text Book: Ch. 1, Ch. 2, Ch. 10.6)

2. Arun K Pujari (2013): Data Mining Techniques, University Press Inia private Ltd. Third Edition. (T.B-2: (T.B.2: Ch 5.4, 5.8, Ch. 6.18).

Note: Theory paper is for 40 Marks and Internal is 10 Marks

B.A/B.Sc. III Year: Statistics Syllabus
(Generic Elective-GE-2)
(Examination at the end of III Year, Semester VI)
GE – 2 –Basic Statistics-2 (with 2 HPW, Credits 2 and Marks 50).

Unit – I

Definition and sample examples of random variables and distribution function, probability mass function and probability density function. Mathematical expectation and moments-simple examples.
Discrete probability distributions: Bernoulli, Binomial, Poisson. (Concept, definition, statements of mean and variance only) with real life examples.
Continuous probability distributions: Uniform, Normal and Exponential distributions (concept, definition, statements of mean, variance and other properties).

Unit – II

Empirical bivariate distributions, Covariance, Karl Pearson coefficient, Rank Correlation, Curve fitting byleast squares principle. Simple linear regression.
Concept and definition of population, parameter, sample, statistic, sampling distribution and standard error.
Properties of Estimates: Unbiasedness, Consistency and Efficiency (concept and definition only), simple examples.
Concept of testing Statistical hypothesis-Definition of Null and Alternative hypothesis, Critical region, Types of errors, level of Significance and Power of a Test.
Tests of significance based on Chi-Square, t and F distributions and ANOVA (One and Two way) with examples (No mathematical derivation only methodology).

List of reference books:

1. V.K.Kapoor and S.C.Gupta: Fundamentals of Mathematical Statistics, Sultan Chand & Sons, New Delhi
2. GoonAM,GuptaMK,Das Gupta B : Fundamentals of Statistics , Vol-I, the World Press Pvt.Ltd.,Kolakota.
3. Charles M.Grinstead and Laurie Snell.J: Introduction to Probability, American Mathematical Society

Note: Theory paper is for 40 Marks and Internal is 10 Marks

B.Sc. (DATA SCIENCE)

Semester Pattern Syllabus (CBCS) : w. e. f. : Academic Year : 2020-21

(With Mathematics Combination)

Year	Semester	Theory / Practical	Paper Title	Work Load (Hrs/Week)	# Credits	Marks
I	FIRST	**Paper - I (DSC - A)**	**Fundamentals of Information Technology**	**4**	**4**	**100**
		Practical – 1	Fundamentals of Information Technology (Lab)	*3*	*1*	*50*
	SECOND	**Paper - II (DSC - B)**	**Problem solving and Python Programming**	**4**	**4**	**100**
		Practical – 2	Problem solving and Python Programming (Lab)	*3*	*1*	*50*
II	THIRD	**SEC – 1**	**University Specified**	**2**	**2**	**50**
		SEC – 2	**Mini Project**	**2**	**2**	**50**
		Paper - III (DSC - C)	**Data Engineering with Python**	**4**	**4**	**100**
		Practical – 3	Data Engineering with Python (Lab)	*3*	*1*	*50*
	FOURTH	**SEC – 3**	**University Specified**	**2**	**2**	**50**
		SEC – 4	**Mini Project**	**2**	**2**	**50**
		Paper - IV (DSC - D)	**Machine Learning**	**4**	**4**	**100**
		Practical – 4	Machine Learning (Lab)	*3*	*1*	*50*
III	FIFTH	**Paper – V (A) (DSE - A)**	**Natural Language Processing**	***4***	***4***	***100***
		Paper – V (B) (DSE - A)	**No SQL Data Bases**	**4**	**4**	**100**
		Practical – 5(A)	Natural Language Processing (Lab)	*3*	*1*	*50*
		Practical – 5(B)	No SQL Data Bases (Lab)	*3*	*1*	*50*
		Paper VI – GE	*Data Structures and Algorithms*	***4***	***4***	***100***
	SIXTH	**Paper – VII (A) (DSE - B)**	**Big Data**	**4**	**4**	**100**
		Paper- VII (B) (DSE - B)	**Deep Learning**	**4**	**4**	**100**
		Practical – 7(A)	Big Data (Lab)	*3*	*1*	*50*
		Practical – 7(B)	Deep Learning (Lab)	*3*	*1*	*50*
		Paper VIII (Project)	***Major Project***	***4***	***4***	***100***

B.Sc. (DATA SCIENCE)
Theory Question Paper Pattern
w.e.f: Academic Year: 2020-21
(With Mathematics Combination)

Time: 3 hours] [Max. Marks: 80

Section - A

Answer any EIGHT questions. All questions carry equal marks. (8Qx4m=32)

1. From Unit I
2. From Unit I
3. From Unit I
4. From Unit II
5. From Unit II
6. From Unit II
7. From Unit III
8. From Unit III
9. From Unit III
10. From Unit IV
11. From Unit IV
12. From Unit IV

Section - B

Answer ALL questions. All questions carry equal marks. (4Qx12m=48)

13. a) From Unit I
    (or)
    b) From Unit I

14. a) From Unit II
    (or)
    b) From Unit II

15. a) From Unit III
    (or)
    b) From Unit III

16. a) From Unit IV
    (or)
    b) From Unit IV

***

B.Sc. I Year I Semester (CBCS) : Data Science Syllabus

(With Mathematics Combination)

(Examination at the end of Semester - I)

Paper – I : Fundamentals of Information Technology

[4 HPW :: 4 Credits :: 100 Marks (External:80, Internal:20)]

Objectives:

1. **To deal with the basic concepts of computers.**
2. **To discuss about the computer hardware, its components and basic computer architecture.**
3. **To understand the basic computer software including the operating system and its concepts.**
4. **To introduce the software development process**
5. **To introduce the basic concept of programming**

Outcomes:

Students should be able to

1. Identify the components of a computer and their functions.
2. Understand the concept of networking, LAN, Internet, and working of www.
3. Understand the notion of problem solving using computer by programming
4. Understand the notion of Software Project and the Process of software development

Unit-I

Data and Information: Introduction, Types of Data, Simple Model of a Computer, Data Processing Using a Computer, Desktop Computer [Reference 1]

Acquisition of Numbers and Textual Data: Introduction, Input Units, Internal Representation of Numeric Data, Representation of Characters in Computers, Error-Detecting Codes [Reference 1]

Unit-II

Data Storage: Introduction, Storage Cell, Physical Devices Used as Storage Cells, Random Access Memory, Read Only Memory, Secondary Storage, Compact Disk Read Only Memory (CDROM), Archival Store [Reference 1]

Central Processing Unit: Introduction, Structure of a Central Processing Unit, Specifications of a CPU, Interconnection of CPU with Memory and I/O Units, Embedded Processors [Reference 1]

Unit-III

Computer Networks: Introduction, Local Area Network (LAN), Applications of LAN, Wide Area Network (WAN), Internet, Naming Computers Connected to Internet, Future of Internet Technology [Reference 1]

Input Output Devices: Introduction, Keyboard, Video Display Devices, Touch Screen Display, E-Ink Display, Printers, Audio Output [Reference 1]

Computer Software: Introduction, Operating System, Programming Languages, Classification of Programming Languages, Classification of Programming Languages Based on Applications [Reference 1]

Unit-IV

The Software Problem: Cost, Schedule, and Quality, Scale and Change [Reference 2]
Software Processes: Process and Project, Component Software Processes, Software Development Process Models [Reference 2]
Programming Principles and Guidelines: Structured Programming, Information Hiding, Some Programming Practices, Coding Standards [Reference 2]

References

1. V Rajaraman. Introduction to Information Technology, 3rd Edition, PHI Learning Private Limited, 2018
2. Pankaj Jalote. Concise Introduction toSoftware Engineering, Springer, 2011

B.Sc. I Year I Semester (CBCS) : Data Science Syllabus

(With Mathematics Combination)

(Examination at the end of Semester - I)

Practical - 1 : Fundamentals of Information Technology (Lab)

[3 HPW :: 1 Credit :: 50 Marks]

Objective

The main objective of this laboratory is to familiarize the students with the basic hardware and software in computers

Exercises

1. Assembly and disassembly of a system box and identifying various parts inside the system box to recognize various parts of a typical computer system
2. Assembly and disassembly of peripheral devices- keyboard and mouse and study of their interface cables, connectors and ports.
3. Installation of Operating Systems-Windows and Linux
4. Disk defragmentation using system tool.
5. Procedure of disk partition and its operation (Shrinking, Extending, Delete, Format).
6. Installing and uninstalling of device drivers using control panel.
7. Working practice on windows operating system and Linux operating system: creating file, folder. Copying, moving, deleting file, folder
8. User Account creation and its feature on Windows Operating System and Changing resolution, color, appearances, and Changing System Date and Time.
9. Installation and using various wireless input devices (Keyboard/Mouse/Scanners etc.,)under Windows/Linux.
10. Study of various types of memory chips and various types of hard disk drives, partition and formatting of hard disk.
11. Installation of scanner, modem and network cards in Windows/Linux.
12. Assembly and disassembly of printer, installing a printer, taking test page, and using printer under Windows/Linux.
13. Installation of application software's – Office Automation, Anti-Virus.
14. Demonstrate the usage of Word and Power point in Windows and Linux
15. Configure Internet connection, Email Account creation, reading, writing and sending emails with attachment.

B.Sc. I Year II Semester (CBCS) : Data Science Syllabus

(With Mathematics Combination)

(Examination at the end of Semester - II)

Paper – II : Problem Solving and Python Programming

[4 HPW :: 4 Credits :: 100 Marks (External:80, Internal:20)]

Objectives

The main objective is to teach Computational thinking using Python.

- To know the basics of Programming
- To convert an algorithm into a Python program
- To construct Python programs with control structures.
- To structure a Python Program as a set of functions
- To use Python data structures-lists, tuples, dictionaries.
- To do input/output with files in Python.
- To construct Python programs as a set of objects.

Outcomes:

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

1. Develop algorithmic solutions to simple computational problems.
2. Develop and execute simple Python programs.
3. Develop simple Python programs for solving problems.
4. Structure a Python program into functions.
5. Represent compound data using Python lists, tuples, dictionaries.
6. Read and write data from/to files in Python Programs

Unit-I

Introduction to Computing and Problem Solving: Fundamentals of Computing – Computing Devices – Identification of ComputationalProblems – Pseudo Code and Flowcharts – Instructions – Algorithms – Building Blocks of Algorithms.

Introduction to Python Programming: Python Interpreter and InteractiveMode– Variables and Identifiers – Arithmetic Operators – Values and Types – Statements,Reading Input, Print Output, Type Conversions, The type() Function and Is Operator, Dynamic and Strongly Typed Language.

Control Flow Statements: The if, The if…else,The if…elif…else Decision Control Statements, Nested if Statement, The while Loop, The for Loop, The continue and break Statements.

Unit-II

Functions: Built-In Functions, Commonly Used Modules, Function Definition and Calling the Function, The return Statement and void Function, Scope and Lifetime of Variables, Default Parameters, Keyword Arguments, *args and **kwargs, Command Line Arguments.

Strings: Creating and Storing Strings, Basic String Operations, Accessing Characters in String by Index Number, String Slicing and Joining, String Methods, Formatting Strings.

Unit-III

Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations andmethods; advanced list processing - list comprehension; Illustrative programs: selection sort,
insertion sort, mergesort, histogram.

Files and exception: text files, reading and writing files, format operator; command line arguments,errors and exceptions, handling exceptions, modules, packages; Illustrative programs: word count, copy file.

Unit-IV

Object-Oriented Programming: Classes and Objects, Creating Classes in Python, Creating Objects in Python, The Constructor Method, Classes with Multiple Objects, Class Attributes versus Data Attributes, Encapsulation, Inheritance The Polymorphism.

Functional Programming: Lambda. Iterators, Generators, List Comprehensions.

References:

1. Introduction to Python Programming. Gowrishankar S., Veena A. CRC Press, Taylor & Francis Group, 2019
2. Allen B. Downey, ``Think Python: How to Think Like a Computer Scientist'', 2nd edition,Updated for Python 3, Shroff/O'Reilly Publishers, 2016 (http://greenteapress.com/wp/think- python/)

Suggested Reading:

1. Learning To Program With Python. Richard L. Halterman. Copyright © 2011
2. Python for Everybody, Exploring Data Using Python 3. Dr. Charles R. Severance. 2016

B.Sc. I Year II Semester (CBCS) : Data Science Syllabus

(With Mathematics Combination)

(Examination at the end of Semester - II)

Practical - 2 : Problem Solving and Python Programming (Lab)

[3 HPW :: 1 Credit :: 50 Marks]

Objective

The main objective of this laboratory is to put into practice computational thinking. The students will be expected to write, compile, run and debug Python programs to demonstrate the usage of

- variables, conditionals and control structures
- functions (both recursive and iterative)
- basic data types as well as compound data structures such as strings, lists, sets, tuples, dictionaries
- object-oriented programming

Installing Python and Setting up the Environment

Python interpreter can be downloaded for Windows/Linux platform using the link below:
https://www.python.org/downloads/windows/

Exercises

I. Programs to demonstrate the usage of operators and conditional statements

1. Write a program that takes two integers as command line arguments and prints the sum of two integers.
2. Program to display the information:
   Your name, Full Address, Mobile Number, College Name, Course Subjects
3. Program to find the largest number among ‘n’ given numbers.
4. Program that reads the URL of a website as input and displays contents of a webpage.

II. Programs to demonstrate usage of control structures

5. Program to find the sum of all prime numbers between 1 and 1000.
6. Program that reads set of integers and displays first and second largest numbers.
7. Program to print the sum of first ‘n’ natural numbers.
8. Program to find the product of two matrices.
9. Program to find the roots of a quadratic equation

III. Programs to demonstrate the usage of Functions and Recursion

10. Write both recursive and non-recursive functions for the following:
    a. To find GCD of two integers
    b. To find the factorial of positive integer
    c. To print Fibonacci Sequence up to given number ‘n’
    d. To convert decimal number to Binary equivalent

11. Program with a function that accepts two arguments: a list and a number ‘n’. It should display all the numbers in the list that are greater than the given number ‘n’.
12. Program with a function to find how many numbers are divisible by 2, 3,4,5,6 and 7 between 1 to 1000

IV. Programs to demonstrate the usage of String functions

13. Program that accept a string as an argument and return the number of vowels and consonants the string contains.
14. Program that accepts two strings S1, S2, and finds whether they are equal are not.
15. Program to count the number of occurrences of characters in a given string.
16. Program to find whether a given string is palindrome or not

V. Programs to demonstrate the usage of lists, sets, dictionaries, tuples and files.

17. Program with a function that takes two lists L1 and L2 containing integer numbers as parameters. The return value is a single list containing the pair wise sums of the numbers in L1 and L2.
18. Program to read the lists of numbers as L1, print the lists in reverse order without using reverse function.
22. Write a program that combine lists L1 and L2 into a dictionary.
19. Program to find mean, median, mode for the given set of numbers in a list.
20. Program to find all duplicates in the list.
21. Program to o find all the unique elements of a list.
22. Program to find max and min of a given tuple of integers.
23. Program to find union, intersection, difference, symmetric difference of given two sets.
24. Program to display a list of all unique words in a text file
25. Program to read the content of a text file and display it on the screen line wise with a line number followed by a colon
26. Program to analyze the two text files using set operations
27. Write a program to print each line of a file in reverse order.

VI. Programs to demonstrate the usage of Object Oriented Programming

28. Program to implement the inheritance
29. Program to implement the polymorphism

VII. Programs to search and sort the numbers

30. Programs to implement Linear search and Binary search
31. Programs to implement Selection sort, Insertion sort