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)

Contents

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)*

Department of Physics
Osmania University
Hyderabad

Scheme of instructions and syllabus
(Choice Based Credit System)
of

B.Sc. Electronics

With effect from: 2019-2020

B.Sc. ELECTRONICS SYLLABUS
SCHEME OF INSTRUCTIONS
UNDER CBCS (w.e.f 2019-2020 academic year onwards)

Year	Semester	Title of the Paper [Theory and Practical]	Instructions Hrs/week	Number of Credits	Marks
1st Year	I Sem	Paper – I : Circuit Analysis	4	4	100
		Practical – I : Circuit Analysis Lab	3	1	50
	II Sem	Paper – II : Electronic Devices	4	4	100
		Practical – II : Electronic Devices Lab	3	1	50
2nd Year	III Sem	Paper – III : Analog Circuits	4	4	100
		Practical – III : Analog Circuits Lab	3	1	50
	IV Sem	Paper – IV : Linear Integrated circuits and Basics of Communication	4	4	100
		Practical – IV : Linear Integrated Circuits and Basics of Communication Lab	3	1	50
3rd Year	V Sem	Paper –V : Discipline Specific Elective – I Digital Electronics (OR) Electronic & Instrumentation	4	4	100
		Practical – V : Discipline Specific Elective – I Digital Electronics Lab (OR) Electronics & Instrumentation Lab	3	1	50
	VI Sem	Paper – VI : Discipline Specific Elective – II Digital Communication (OR) 8051 Microcontroller & Applications	4	4	100
		Practical – VI : Discipline Specific Elective – II Digital Communication Lab (OR) 8051 Microcontroller & Applications Lab	3	1	50

Total Credits: 30

Skill Enhancement Courses:

1. **Electronic hardware and networking**
2. **Mat-lab and Applications**
3. **Basic Instrumentation**
4. **Digital Photography**

- **Generic Elective (GE): Basic Electronics**
- **Project work (OR) Optional Paper (Digital System Design using VHDL)**

B.Sc. ELECTRONICS SYLLABUS
B.Sc. I YEAR
Semester – I

DSC- Paper –I : Circuit Analysis

Total number of hours: 60
No of hours per week:4
Credits:4

UNIT - I

AC Fundamentals: The sine wave –average and RMS values – The J Operator –Polar and Rectangular forms of complex numbers – Phasor diagram-Complex impedance and admittance.

Kirchhoff's Current and Voltage Laws: Concept of Voltage and current sources-KVL and KCL-application to simple circuits (AC and DC) consisting of resistors and sources – Node voltage analysis and Mesh analysis.

UNIT-II

Network Theorems (DC and AC): Superposition Theorem, Thevenin's Theorem, Norton's Theorem, Maximum power transfer Theorem, Reciprocity Theorem, Milliman's Theorem, Application to simple Networks.

UNIT-III

RC and RL Circuits: Transient Response of RL and RC Circuits with step input, Time constants. Frequency response of RC and RL circuits, Types of filters – Low pass filter and High pass filter-frequency response, passive differentiating circuit and passive integrating circuit.

UNIT-IV

Resonance: RLC Series and parallel resonance circuits –Resonant frequency –Q Factor- Bandwidth-Selectivity.

Cathode Ray Oscilloscope: Cathode Ray Tube (CRT) and its working, electron gun focusing, deflection sensitivity, florescent screen. Measurement of Time period, Frequency, Phase and amplitude.

Reference Books:

1) Basic Electronics-Bernard Grob10th edition (TMH)

2) Circuit Analysis-P.Gnanasivam Pearson Education

3) Circuit and Networks-A. Sudhakar& S. Pallri (TMH)

4) Pulse, digital & switching waveforms-Milliman & Taub.

5) Networks, Lines and Fields-John Ryder (PHI)

6) Network theory-Smarajit Ghosh (PHI)

B.Sc. I Year, Semester – I : Electronics Practical

Paper – I : Circuit Analysis Lab

No. of hours per week : 3

1. Measurement of peak voltage, frequency using CRO.
2. Measurement of phase using CRO.
3. Thevenin's theorem and Norton's theorem – verification.
4. Maximum power transfer theorem – verification.
5. CR circuit – Frequency response - (Low pass and High pass)
6. CR and LR circuits – Differentiation and integration – tracing of waveforms.
7. LCR – Series resonance circuit – frequency response – Determination of f_o, Q and band width.
8. Simulation: i) verification of KVL and KCL.

   ii) study of network theorems.

   iii) study of frequency response (LR).

Note: Student has to perform minimum of <u>Six</u> experiments.

<u>Reference Books:</u>

1) Lab manual for Electronic Devices and Circuits – 4th Edition. By David A Bell – PHI
2) Basic Electronics – A Text Lab Manual –Zbar, Malvino, Miller.

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B.Sc. ELECTRONICS SYLLABUS
B.Sc. I YEAR
Semester - II
DSC- Paper –II : Electronic Devices

Total number of hours : 60
No of hours per week: 4
Credits :4

UNIT-I

PN Junction: Formation of PN junction, Depletion region, Junction capacitance, Diode equation (no derivation) Effect of temperature on reverse saturation current, V-I characteristics and simple applications of i) Junction diode, ii) Zener diode, iii) Tunnel diode and iv) Varactor diode.

UNIT-II

Bipolar Junction Transistor(BJT) : PNP and NPN transistors, current components in BJT, BJT static characteristics (Input and Output), Early effect, CB, CC, CE configurations of transistor and bias conditions (cut off, active, and saturation regions), CE configuration as two port network, h–parameter model and its equivalent circuit. Determination of h – parameters from the characteristics, Load line analysis (AC and DC). Transistor Biasing – Fixed and self bias.

UNIT-III

Field Effect Transistor (FET): Construction and working of JFET, output and transfer characteristics of FET, Determination of FET parameters. Application of FET as Voltage variable resistor. Advantages of FET over BJT.

MOSFET: Construction and working of enhancement and depletion modes, output and transfer characteristics Application of MOSFET as a switch.

Uni Junction Transistor (UJT): Construction and working of UJT and its Characteristics. Application of UJT as a relaxation oscillator.

UNIT-IV

Silicon Controlled Rectifier (SCR): Construction and working of SCR. Two transistor representation, Characteristics of SCR. Application of SCR for power control.

Photo electronic Devices: Construction and Characteristics of Light Dependent Resistor (LDR), Photo voltaic Cell, Photo diode, Photo transistor and Light Emitting Diode (LED).

Reference Books:

1) Electronic Devices and circuits-Millman and Halkias,(TMH)
2) Principles of Electronics-V.K.Mehta & Rohit Mehta
3) Electronic Devices and Circuits-Allen Moltershed (PHI)
4) Basic Electronics and Linear Circuits-Bharghava U
5) Electronic Devices and Circuits-Y.N.Bapat
6) Electronic Devices and Circuits-Mithal.
7) Experiments in Electronics-S.V.Subramanyam.

B.Sc. I Year, Semester – II : Electronics Practical

Paper – II : Electronic Devices Lab

No. of hours per week: 3

1. To draw volt- ampere characteristics of Junction diode and determine the cut – in voltage, forward and reverse resistances.
2. Zener diode V – I Characteristics – Determination of Zener breakdown voltage.
3. Voltage regulator (line and load) using Zener diode.
4. BJT input and output characteristics (CE configuration) and determination of 'h' parameters.
5. FET – Characteristics and determination of FET parameters.
6. UJT characteristics – determination of intrinsic standoff ratio.
7. UJT as relaxation oscillator.
8. Characteristics of LDR/Photo diode/Photo transistor/Solar cell.

Note: Student has to perform minimum of <u>Six</u> experiments.

<u>Reference Books:</u>

1) Lab manual for Electronic Devices and Circuits – 4^{th} Edition. By David A Bell - PHI

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B.Sc. ELECTRONICS SYLLABUS

B.Sc. II YEAR

Semester - III

DSC- Paper - III : Analog Circuits

Total number of hours : 60
No of hours per week: 4
Credits :4

UNIT – I

Rectifiers and filters: Rectifiers– half wave, full wave and bridge rectifiers, Efficiency, Ripple factor, regulation, harmonic components in rectified output, Filters – choke input (inductor) filter, Shunt capacitor filter, L section and π section filters.

UNIT – II

Regulated Power Supplies: Block diagram of regulated power supply, Transistor Voltage Regulators – series and shunt type, three terminal IC regulators (78XX and 79XX), Principle and working of switch mode power supply (SMPS). UPS –Principle and working.

UNIT – III

Transistor amplifier: Classification of amplifiers, Hybrid π model of a transistor, Single stage RC coupled amplifier – frequency response and analysis.

Feedback in amplifiers: Positive and negative feedback, Effect of negative feedback on gain, bandwidth, noise, input and output impedances. Emitter follower, Darlington pair and its advantages

UNIT – IV

Oscillators: Barkhausen criterion for sustained oscillations, RC oscillators- RC phase shift and Wien's bridge oscillators, LC oscillators- Hartley and Colpitt.

Multi-vibrators: Astable, Mono stable and Bi-stable multi-vibrators (Qualitative treatment only)

Reference Books:

1. Electronic Devices and Circuits-Millman and Halkias (TMH)
2. Basic Electronics and linear circuits - Bhargava, Kulshreshta & Gupta TMH
3. A first course in Electronics-AA Khan and KK Dey-PHI
4. Electronic Devices and Circuit Theory-Robert L Boylestad& Louis Nashelsky
5. Pulse, Digital and Switching circuits by Milliman and Taub

B.Sc. II YEAR, Semester – III : Electronics Practical

Paper - III: Analog Circuits Lab

No. of hours per week : 3

1. Study of HWR, FWR and bridge rectifier, determination of ripple factor.
2. Series inductor, shunt capacitor, L-section and π-section filters; determination of ripple factor using Full wave Rectifier.
3. Study of voltage regulator using IC's - 78XX & 79XX.
4. Colpitt oscillator – determination of frequency.
5. RC Phase shift oscillator- determination of frequency
6. Astable multi-vibrator – determination of time period and duty cycle.

Simulation experiments:

i) Rectifiers

ii) RC coupled amplifier

iii) Wein bridge oscillator

iv) Colpitt oscillator

v) RC phase shift oscillator

vi) Astable multi-vibrator

Note: Student has to perform minimum of <u>Six</u> experiments

<u>Reference Books:</u>

1) Lab manual for Electronic Devices and Circuits – 4th Edition. By David A Bell – PHI
2) Basic Electronics – A Text Lab Manual –Zbar, Malvino, Miller.

B.Sc. ELECTRONICS SYLLABUS

B.Sc. II YEAR, Semester - IV

DSC- Paper - IV: Linear Integrated Circuits and Basics of Communication

Total number of hours : 60
No of hours per week: 4
Credits :4

UNIT – I

Operational Amplifiers: Emitter Coupled Differential amplifier, Block diagram of Op.amp. Characteristics of Op.amp, Op.amp parameters-Input resistance, Output resistance, Common mode rejection ratio (CMMR), Slew rate, offset voltages, Input bias current, Basic Op-Amp circuits-Inverting Op-Amp, Non-inverting Op-Amp, Op Amp as: Summing amplifier, subtractor, Comparator, Voltage follower, Integrator, and Differentiator and : logarithmic amplifier

UNIT- II

Applications of Op-Amps: Sine wave [Wien Bridge] generator and square wave [Astable] generator, Triangular wave generator, Mono stable multi-vibrator, IC 555 Timer [Block diagram and its working], IC 555 as mono stable and astable multi-vibrators.

UNIT – III

Modulation: Need for modulation-Types of modulation- Amplitude, Frequency and Phase modulation.

Amplitude modulation: Analysis of Amplitude modulation, side bands, modulation index, AM modulator, balanced modulator, Demodulation – diode detector.

UNIT – IV

Frequency modulation: Analysis of FM**,** Working of simple frequency modulator, - detection of FM waves – FM Discriminator. Advantages of frequency modulation. AM and FM Transmitters and radio receivers [block diagram approach]. Introduction to PAM, PPM, PWM, and PCM, Delta modulation.

Reference Books:

1. Op amps and linear Integrated Circuits – Ramakant Gayakwad, PHI
2. Linear Integrated Circuits- D Roy Choudhury and Shail B Jain
3. Electronic Communication Systems-George Kennedy & Bernard Davis
4. Principles of Electronic Communication Systems-Louis E Freznel, TMH

B.Sc. II YEAR ,

Semester – IV: Electronics Practical

Paper - IV: Linear Integrated Circuits and Basics of Communication Lab

Total number of hours per week: 3

Practical : Using IC 741OpAmp and IC 555 Timer :

1. Op amp as inverting Amplifier- determination of gain (with AC and DC).
2. Op amp as non- inverting Amplifier- determination of gain (with AC and DC).
3. OP Amp as Summing amplifier and comparator(Zero crossing detector)
4. Astable multi-vibrator – determination of time period and duty cycle.
5. Mono stable multi-vibrator- determination of gate width.
6. Integrator/ Differentiator – study of wave forms.
7. Astable multi-vibrator using IC 555
8. Mono stable multi-vibrator using IC 555.
9. AM modulator and detector
10. FM modulator and detector

Simulation of all the above experiments:

1. Inverting and Non-inverting amplifiers and comparator
2. Integrator/ Differentiator using op amp
3. Wein bridge oscillator
4. Astable multi-vibrator using Op Amp
5. Astable multi-vibrator using IC 555

Note: Student has to perform minimum of Six experiments

Reference Books:

1) Lab manual for Electronic Devices and Circuits – 4th Edition. By David A Bell – PHI
2) Basic Electronics – A Text Lab Manual –Zbar, Malvino, Miller.

B.Sc. ELECTRONICS SYLLABUS

B.Sc. III YEAR, Semester - V

Paper - V: Digital Electronics (DSE - I)

Total number of hours : 60
No of hours per week: 4
Credits :4

UNIT-I

Number system and Logic gates: Conversions of Binary, octal, Decimal & hexadecimal number systems, Binary addition and subtraction (1's and 2's complement methods).
Logic gates- OR, AND, NOT, XOR, NAND, NOR gates and their Truth tables – Design of basic gates using the Universal gates- NAND and NOR gates, Half adder, Full adder and parallel adder logic circuits. Logic families and their characteristics – TTL, CMOS and ECL logic circuits.

UNIT-II

Boolean algebra and Combinational logic circuits: Boolean algebra- Laws and identities, DeMorgan's Theorems. Simplification of Boolean expressions using Boolean identities- Reduction of Boolean expressions using Karnaugh Maps - Sum of Products (SOP) representation (up to four variables). Multiplexer, De-Multiplexer, Decoder (3 to 8) and Encoder (8 to 3).

UNIT-III

Sequential logic circuits: Flip-flops - SR, D, JK, T and Master-Slave JK; Registers - Shift Registers- SISO, SIPO, PISO and PIPO Registers.

Counters: 4-bit Asynchronous (Ripple) counter, Modulo-N counter, synchronous counter. Up/down counters – ripple counter IC7493 - Decade counter IC7490 – working, truth tables and timing diagrams.

UNIT-IV

Introduction to 8085 Microprocessor & its architecture: Architecture of 8085 microprocessor – CPU – Timing & Control Unit – Instruction cycle, Fetch Cycle, Execute cycle (Timing diagram), Machine cycle and clock states. Interrupts – Hardware and Software, Address space partitioning – Memory mapped I/O & I/O mapped I/O.

Instruction set of 8085 microprocessor: Classification - Data transfer operations, Arithmetic operations, logical operations, Branch control operations and stack, I/O and Machine control operations. Stack and Subroutines, Addressing modes

Reference Books:

1. Digital Principles and Applications – Malvino& Leach - TMH.
2. Digital Principles and Applications-Ronald J.Tocci-– Pearson Education.
3. Text book of Electronics Bsc III year (vol.III)-Telugu Akademi
4. Digital Fundamentals – F.Loyd& Jain – Pearson Education.
5. Fundamentals of Digital Circuits – Anand Kumar – PHI
6. Digital Electronics Principles and Integrated circuits – Maini – Wiley India.
7. Digital Electronics - Gothman

B.Sc. ELECTRONICS SYLLABUS

B.Sc. III YEAR , Semester – V Practical

Paper –V : Digital Electronics Lab

No. of hour per week :3

- Verification of truth tables of AND, OR, NOT, NAND, NOR, EXOR Gates using IC 74XX series.
- Construction of basic gates using NAND and NOR gates.
- Construction of Half Adder using gates. Verification of truth table.
- Construction of Full Adder using gates and verification of truth table.
- Verification of truth tables of flip flops: RS, D, and JK using IC's.
- Construction of binary counters 7493

Simulation experiments:

1. 4bit parallel adder using Full adders.
2. Decade counter using JK flip flops.
3. Up/Down counters using JK flip flops.
4. Up/down counter using 74193
5. Multiplexer/De-Multiplexer.
6. Encoder.

Note: Student has to perform minimum of <u>Six</u> experiments

<u>Reference Books:</u>

1. Lab manual for Electronic Devices and Circuits – 4th Edition. By David A Bell – PHI
2. Basic Electronics – A Text Lab Manual –Zbar, Malvino, Miller.

B.Sc. ELECTRONICS SYLLABUS
B.Sc. III YEAR, Semester - V

Paper - V (Elective)

ELECTRONIC INSTRUMENTATION (DSE - I)

Total number of hours : 60
No of hours per week: 4
Credits :4

Unit – I: ***CHARACTERISTICS OF AN INSTRUMENT***

Functional elements of a measurement system – Static characteristics – Accuracy, precision, bias, linearity, threshold, resolution, hysteresis, dead space, scale readability, span, static stiffness, input impedance, repeatability and reproducibility - Errors and calculation of errors in overall system – Dynamic characteristics – Zero, first and second order instruments - Responses for step, impulse, ramp and sinusoidal inputs. Classification of standards, IEEE Standards, Elements of ISO 9001, Quality of management Standards.

Unit –II: ***TRANSDUCERS AND SENSORS***

Transducer: Transducers, Factors for selection of a transducer, Definition of transducer and sensor – Classification of transducers – Pressure (strain gauge, piezoelectric transducer), displacement (potentiometric, LVDT), Ultra Sonic Transducers (ultrasonic sensors)

Microphones: Microphones and their types, Temperature measurement, resistance wires thermometers, semiconductor thermometers and thermocouples, temperature (thermistor) and photosensitive (Vacuum and Gas filled phototubes, photoconductive cell, photovoltaic cell, photo emissive) transducers. Flow Transducers – Flow Transducers – Flow Meter, Force Transducers – Dynamometer, Acceleration Transducer – accelerometer. Application of Transducers.

Unit –III: ***BRIDGE MEASUREMENTS***: Introduction - Wheatstone bridge - Kelvin bridge –Guarded Wheatstone bridge - AC bridges and their applications – Maxwell bridge – Hay bridge - Schering bridge - Wien bridge.

Unit – IV: ***TESTING INSTRUMENTS:*** Oscilloscopes – Block diagram – CRT Circuits – Vertical and horizontal deflection systems – Delay line, Multiple trace – Probes – Special Oscilloscopes.

Measuring Instruments: DC Voltmeters, DC Current Meters, AC Voltmeters and Current Meters, Ohmmeters, Multimeters, Meterprotection, Extension of range, True RMS Responding Voltmeters, Specification of instruments.

Books for Study:

1. C. S. Rangan, G. R. Sarma and V. S. V. Mani, 1999, Instrumentation Devices and Systems, *Tata McGraw-Hill, New Delhi.*
2. A. D. Helfrick and W. D. Copper, 1992, Modern Electronic Instrumentation and Measurement Techniques, *Prentice-Hall of India, New Delhi.*
3. A. K. Sawhney, A Course in Electrical and Electronic Measurement and Instrumentation, *Dhanpat Rai & Sons.*

Books for Reference:

1. E. O. Doebelin, 1983, Measurement Systems Application and Design, *International Edition, 3rd Ed., McGraw-Hill, NY.*
2. D. V. S. Moorthy, 1995, Transducer and Instrumentation, *Prentice-Hall of India,NewDelhi.*
3. J. W. Dalley, W. F. Riley and K. G. McConnel, 1993, Instrumentation for Measurements,*Wiley, NY.*

3. B. C. Nakre and K. K. Chaudry, Instrumentation Measurements and Analysis, *Tata McGraw-Hill, New Delhi.*

5. D. A. Skoog, Principles of Instrumental Analysis, *3rd Ed., Saunders College Publishing.*

B.Sc. ELECTRONICS SYLLABUS
B.Sc. III YEAR, Semester – V

ELECTRONIC INSTRUMENTATION LAB

No. of hours per week: 3

Experiments:

1. Temperature Transducer – (Thermocouple/ Thermistor)
2. Pressure Transducer – Strain Gauge
3. Displacement Transducer – LVDT (Linear Variable Differential Transformer)
4. Ultrasonic Transducer (Ultrasonic sensor)
5. Flow Transducer - Flow Meter
6. Force Transducer – Dynamometer
7. Acceleration Transducer – Accelerometer
8. Photovoltaic (Solar cell)
9. Passive Transducer photo cell (LDR)
10. CRO characteristics
11. DC Voltmeter / DC Current meter
12. AC Voltmeter / AC Current meter
13. Multi meter

B.Sc. ELECTRONICS SYLLABUS
B.Sc. III YEAR, Semester - VI
Paper – VI (Elective)
DIGITAL COMMUNICATION (DSE- II)

Total number of hours : 45
No of hours per week: 3
Credits :4

Unit – I:

Introduction: Need and Necessity of Digitalization, Advantages of Digital communication, Elements of Digital Communication.

Signal analysis: Complex Fourier Spectrum, Fourier transform, Properties of Fourier transform - Random signals and noise, Correlation and Power spectrum

Information Theory: Introduction, Information Entropy, Properties of Entropy, Information rate, Types of information Sources, Channels, Types of Channels, Joint entropy, Conditional entropy, Redundancy, Mutual information, Channel capacity.

Unit- II:

Digital Communication Systems: Pulse Amplitude Modulation (PAM), Pulse Width Modulation (PWM), Pulse Position Amplitude (PPM), Pulse Code Modulation (PCM), Delta modulation, Adaptive delta modulation, Quantization and Noise consideration

Digital Transmission and Reception: Timing, base band systems, Amplitude Shift Keying (ASK), Frequency Shift Keying (FSK), Phase shift Keying(PSK), Quadrature Amplitude Modulation(QAM).

Unit - III:

Error detection and coding: Parity check, CRC, Hamming distance, Hamming codes, cyclic codes, line synchronization codes, Manchester code, NRZ coding, Walsh codes.

Unit -IV:

Case studies: cellular concepts, global positioning (GPS), Facsimile, Video text, Wifi, Bluetooth, IOT, Cognitive radio.

Reference Books:

1. Analog and Digital Communication – Simon Haykin, John Wiley, 2005
2. Electronics Communication System-Fundamental through Advanced-Wayne Tomasi, 5th Edition, PHI, 2009.
3. Principles of Communication Systems – Herbert TAub, Donald L Schiling, Goutam Ssha, 3rd Edition, Mcgraw-Hill, 2008.
4. Electronic Communications – Dennis Roddy and John Coolean, 4th Edition, PEA, 2004
5. Electronics & Communication System – George Kennedy and Bernard Davis, TMH, 2004.
6. Analog and Digital Communication – K.Sam Shanmugam, Wiley, 2005
7. John G. Proakis, "Digital Communication", 4th Edition, Tata McGraw-Hill publishing company Limited, New Delhi, 2003.
8. P Ramakrishna Rao, "Digital Communication", Tata McGraw-Hill Education Private Limited, New Delhi, 2011.
9. Analog and Digital Communication Systems – M.S. Roden, 3rd Edition, Prentice Hall of India
10. Modern Digital and Analog Communication Systems-B.P. Lathi.
11. Communication Techniques for digital and Analog signals – M. Kanefsky, John Wiley and Son.
12. Telecommunication – T.H. Brewster, McGraw Hill.
13. Principles of Digital communication, Das Chatterjee and Mallic, Wiley Eastern Ltd.

B.Sc. ELECTRONICS SYLLABUS
B.Sc. III YEAR, Semester – VI Practical

DSE - Paper – VI : DIGITAL COMMUNICATION Lab

No. of hours per week :3

I Experiments in Internetworking:

1. Pulse Amplitude Modulation
2. Pulse Code Modulation
3. Pulse Width Modulation
4. Pulse Phase Modulation
5. Amplitude Shift Keying
6. Frequency Shift Keying
7. Delta modulation
8. Phase shift Keying

II Experiments in Data Communication.

1) Study of serial communication.
2) Study of wireless communications.
3) Study of parallel communication.

B.Sc. ELECTRONICS SYLLABUS
B.Sc. III YEAR, Semester – VI (Elective)

8051 Microcontroller and Applications (DSE-II)

Total number of hours : 60
No of hours per week: 4
Credits :4

UNIT-I

The Microcontroller 8051: Overview and block diagram of 8051. Architecture and pin diagram of 8051. Data types and directives, Memory Organization, register banks and Stack Pointer. PSW Register, other special function registers, I/O port organization. Interrupts and Timer/Counter modules.

UNIT-II

Instruction set of 8051 microcontroller: Classification- Data transfer, Arithmetic, logical, Single Bit, Jump, Loop and CALL instructions and their usage. Addressing modes - Immediate, Register, Direct, Indirect, Absolute addressing, Relative addressing, Indexed Addressing and accessing memory using various addressing modes.

UNIT-III

Programming examples of microcontroller 8051: Addition, Subtraction, division, picking the smallest/largest number among a given set of numbers, arranging a given a set of numbers in ascending/descending order, Subroutines, I/O Programming, Bit manipulation. Accessing a specified port terminal and generating wave forms.

Timer/Counter Programming in 8051: Programming 8051 timers- basic registers of timers- Timer0, Timer1 registers. TMOD register, TCON register. Timer modes - Mode1, Mode2 programming. Counter mode programming. Program to generate time delay.

Unit – IV

Serial communications: Serial communication, Types, modes and protocols, Data transfer rates, serial communication program- SBUF and SCON registers, RS232 standards, Programming timer Interrupts,

Applications of Micro controller: Displaying information on a LCD, Interfacing a keyboard, Interfacing a temperature sensor, R-2R ladder Interfacing of DAC 0808 to microcontroller, successive approximation ADC, Duel slope ADC Interfacing of ADC 0804 to microcontroller, Seven segment LED.

Reference Books:

1) The 8051 Microcontrollers and Embedded Systems – Muhammad Ali Mazidi and Janice gillipsie Mazidi – Pearson Education Asia, 4th Reprint, 2002.
2) Text book of Electonics Bsc III year (vol.III)-Telugu Akademi.
3) Fundamentals of Microprocessors and Microcontrollers – B.Ram.
4) The 8051 Microcontroller – architecture, programming and applications KennthJ. Ayala-Penram International Publishing, 1995.
5) Micro controllers-Theory and Applications-Ajay V.Deshmukh.
6) Micro-controller 8051, D. Karuna Sagar, Narosa Publications (2011)

B.Sc. ELECTRONICS SYLLABUS
B.Sc. III YEAR, Semester VI – Practical (Elective)

8051 Microcontroller and applications Lab

No. of hours per week:3

Experiments using 8051 microcontroller:

1. ADD, SUB, DAA, Multiplication of two numbers using MUL command (later using counter method for repeated addition)
2. Division of two numbers using DIV command (later using counter method for repeated subtraction).
3. Pick out the largest/smallest number among a given set of numbers.
4. Arrange the given numbers in ascending/descending order.
5. Generate a specific time delay using timer/counter.
6. Interface ADC and a temperature sensor to measure temperature.
7. Interface DAC and generate a staircase wave form with a step duration and number of steps as variables.
8. Flash a LED connected at a specified out port terminal.
9. Interface stepper motor to rotate clock wise / anti clock wise through a given angle steps.

Experiments with Keil Software:

1. Write a program to pick out largest/smallest number among a given set of number.
2. Write a program to arrange a given set of numbers in ascending/descending order.
3. Write a program to generate a rectangular/square wave form at specified port.
4. Write a program to generate a time delay using timer registers.

Note: Student has to perform minimum of Six Experiment

(SKILL ENHANCEMENT COURSE)

Electronics Hardware and Networking

Unit-I :

Electronics Hardware: Active and passive components, transducers, classification of transducers based on electrical principle involved.

Power supplies: - DC regulated power supplies (Block diagram approach), SMPS, UPS.
Integrated Circuit (IC's) – advantages and Limitations of IC's, scale of integration, classification of IC's by structure.

Hardware Identification: Cables and Connectors, motherboard, mother board Components, CPU (Processor), memory, RAM and ROM.

Unit-II :

Network: Introduction to network, topo1opies and transmission media. Introduction to LAN, MAN and WAN (Architecture only). Ethernet, token ring.

Protocol: Need for protocol architecture, OSI reference mode1, TCP/IP model.

Internet protocol: IP addresses and classification, architecture of IPV4 and IPV6.

Network Devices: Switches, Bridges, Hubs, Router, Wi-Fi, Bluetooth (Architecture).

Reference books:

1. Basic Electronics by B.L. Theraja-S. Chand.
2. Peter Norton's Introduction to computers-TATA McGRAW-HILL 5th Edition.
3. Data and computer communication by William Stallings —PH Publications 7"' Edition.
4. Data communications and Networking by Behrouz A.Forouzan-TMH 3rd Edition.

(SKILL ENHANCEMENT COURSE)

MATLAB and its Applications

Unit – I:

Introduction to MATLAB – Characteristic-understanding MATLAB-how does MATLAB make work so easy- MATLAB used as calculator –need of MATLAB-features of MATLAB-5-major parts of MATLAB-desktop tools and development environment-current folde-command window- workspace-command history- MATLAB version – MATLAB complier-Advantages-disadvantages of MATLAB-uses of MATLAB

Unit – II:

Application of MATLAB Basic MATLAB commands-introduction to vector-matrix-vector matrix opererations MATLAB code for-inverse of Matrix-Determinant of Matrix-tranpose of matrix.

Plotting basic plotting commands-different types of plots-2-D plotting-xlabel-y-label-linewidth-Application of MATLAB in various fields.

Reference Books:

1. Getting started with MATLAB: A Quick Introduction for Scientist & Engineers by Rudra Pratap
2. MATLAB Programming for Engineers by Stephen J Champ
3. A concise introduction to matlab by William j Palm
4. MATLAB and its Applications in Engineering by BAnsal Goel Sharma
5. A Texbook on MATLAB Programming for Engineering and Science by Ray Dipankar

(SKILL ENHANCEMENT COURSE)

BASIC INSTRUMENTATION SKILLS

(Credits: 02)

This course is to get exposure with various aspects of instruments and their usage through hands-on-mode. Experiments listed below are to be in communication of the topics

UNIT : I

Basic of Measurement: Instruments accuracy, precision, sensitivity, resolution range etc. Errors in measurements and loading effects.

Multimeter: Principles of measurement dc voltage and dc current, ac voltage, ac current and resistance. Specifications of a multimeter and their significance.

Electronic Voltmeter: Advantage over conventional multimeter for voltage measurement with respect to input impedance and sensitivity. Principles of voltage, measurement (block diagram only). Specifications of an electronic Voltmeter/ Multimeter and their significance.

AC millivoltmeter: Type of AC millivoltmeters: Amplifier- rectifier, and rectifier- amplifier. Block diagram ac millivoltmeter, specifications and their significance.

Cathode Ray Oscilloscope: Block diagram of basic CRO. Construction of CRT, Electron gun, electrostatic focusing and acceleration (Explanation only- no mathematical treatment), brief discussion on screen phosphor, visual persistence & chemical composition, Time base operation, synchronization, front panel controls. Specification of a CRO and their significance.
Use of CRO for the measurement of voltage dc and ac frequency, time period. Special features of dual trace, introduction to digital oscilloscope, probes. Digital storage
Oscilloscope: Block diagram and principle of working.

UNIT : II

Signal Generators and Analysis Instruments: Block diagram, explanation and specifications of low frequency signal generators. Pulse generator, and function generator. Brief idea for testing specifications. Distortion factor meter, wave analysis.

Impedance Bridges & Q-Meters: Block diagram of bridge. working principles of basic (balancing type) RLC bridge. Specifications of RLC bridge. Block diagram & working principles of a Q- Meter. Digital LCR bridges.

Digital Instruments: Principle and working of digital meters. Comparison of analog & digital instruments. Characteristics of a digital meter. Working principles of digital voltmeter.

Digital Multimeter: Block diagram and working of a digital multimeter. Working principle of time interval. frequency and period measurement using universal counter/ frequency counter, time- base stability, accuracy and resolution.

The test of lab skills will be of the following test items:

1. Use of an oscilloscope.
2. CRO as a versatile measuring device.
3. Circuit tracing of Laboratory electronic equipment.
4. Use of Digital multimeter/VTV M for measuring voltages.
5. Circuit tracing of Laboratory electronic equipment.
6. Winding a coil / transformer.
7. Study the layout of receiver circuit.
8. Trouble shooting a circuit
9. Balancing of bridges

(SKILL ENHANCEMENT COURSE)

DIGITAL PHOTOGRAPHY

Unit-I:

Introduction of digital photography-the past and future, types of digital cameras, jump start-taking photos with full auto mode, camera control, composing images, capturing images, continuous photography, playback mode.

Image sensors – introduction types image size and aspects ratios, sensitivity and noise, cleaning.

Introduction: understanding the terminology used for digital camera CCD, ISO, DSLR camera.

Using different methods in accordance with various situations: Taking photos of people. Taking photos of landscape, Taking close-up photos, Taking photos at night

Unit-II:

Acquiring basic knowledge of taking a picture with the digital camera: Push the shutter, Good composition of photos, White balance setting, Exposure compensation**.** Flash control, Shutter speed priority mode, Selective focus.

Photo Shop Software: Introduction – features – masking – images framing – cloning – photo repairing

Reference Books:

1. The text book of digital photography – Dennis P. Curtin
2. Shoot like a Pro Digital photogaraphy techniques-juile aadir king
3. The digital photograph book scott kelby
4. Freeman Patterson “The Art of Seeing” by Key Porter books. Tim Fitzharris “Landscape Photography” Firefly books.

Recommended Websites:

Articles, Pictures, Videos, online learning – www.canadiannaturephotographer.com Articles on composition – photoinf.com, The place to go and read before you buy a camera – www.dpreview.com

GENERIC ELECTIVE

Basic Electronics

Course Objective:

To analyze the behavior of semiconductor diodes in Forward and Reverse bias
To design of Half wave and Full wave rectifiers
To explore V-I characteristics of Bipolar Junction Transistors in CB, CE and CC configuration.

Course Outcomes: Students will be

Able to learn about forward biased and reversed biased circuits
Able to plot V-I Characteristics of diode and transmission
Able to design combinational logic circuits and PLDs.

Unit – I :

Units and Definitions: SI units, Electric charge, Electric field, Electric potential, Potential difference, Voltage, EMF.

Resistors: Concept of resistance, V-I relation in resistor, ohm's law and its limitations, types of resistors and their properties and applications, Color Codes, Combination of resistors in series and parallel.

Capacitors: concept of capacitance, V-I relation in capacitor, energy stored in capacitance, types of capacitors & their properties and applications, Color Codes, Combination of capacitors in series and parallel.

Inductors: Concept of inductance, V-I relation in inductor, energy stored in inductors. Mutual inductance and coefficient of coupling, types of inductors and applications, Colour Codes, Combination of inductors in series and parallel.

Unit-II:

Simple Circuits: Concepts of impedance and admittance, network definition. Circuit elements, branch, lumped and distributed network, mesh and node, concepts of voltage and current both ideal and practical.

Passive networks: Krichoff's Voltage Law (KVL), Krichoff's Current Law (KCL).

Unit-III:

The concept of basic semiconductor: P-Material, N-Material, formation of PN junction, Formation of PN junction, Depletion region, Junction capacitance, forward bias, reverse bias, Diode equation (no derivation) and its interpretation, Effect of temperature on reverse saturation current, V-I characteristics and simple applications of i) Junction diode, ii) Zener diode, iii) Tunnel diode and iv) Varactor diode. Zener diode as voltage regulator.

Rectifiers: Rectifiers— half wave, full wave and bridge rectifiers, Efficiency, Ripple factor, regulation, harmonic components in rectified output.

UNIT-IV:

Bipolar Junction Transistor (BJT) : PNP and NPN transistors, current components in BJT (I_E , I_B, I_C, I_{CO}), BJT static characteristics (Input and Output), Early effect, CB, CC, CE configurations of transistor and bias conditions (cut off, active and saturation regions).

Reference Books:

1) Basic Electronics-Benard grob10th edition(TMH)

2) Circuit analysis-P,Gnanasivam education

3) Circuit and networks-A.Sudhakar&s.Pallari(TMH)

4) Electronic devices and circuits-Milman and Halkias(TMH)

5) Principles of electronics-V.K.mehta&rohit Mehta

6) Electronic devices and circuits-Allen Moltershed(PHI)

7) Basic electronics and linear circuits-Bhargava U

8) Electronic devices and Circuits-Y.N.Bapat

9) Electronic devices and Circuits-Mithal

B.Sc. ELECTRONICS – III YEAR

Semester – VI Generic Elective (GE)

Optional Paper: Digital System Design Using VHDL

Total No. of hours : 60
No. of hours per week : 4
Credits : 4

UNIT – I:

Fundamental Concepts: Modeling Digital Systems, Domains and Levels of Modeling, Modeling Languages,VHDL Modeling Concepts, Learning a New Language: Lexical Elements and Syntax.

Scalar Data Types and Operations: Constants and Variables, Scalar Types, Type Classification, Attributesof Scalar Types, Expressions and Operators.

Sequential Statements: If Statements, Case Statements, Null Statements, Loop Statements, Assertion andReport Statements.

UNIT – II:

Composite Data Types and Operations: Arrays, Unconstrained Array Types, Array Operations andReferencing, Records.

Basic Modeling Constructs: Entity Declarations, Architecture Bodies, Behavioral Descriptions, StructuralDescriptions, Design Processing.

Subprograms: Procedures, Procedure Parameters, Concurrent Procedure Call Statements, Functions,Overloading, Visibility of Declarations.

UNIT – III:

Packages and Use Clauses: Package Declarations, Package Bodies, Use Clauses, The Predefined PackageStandard.

Resolved Signals: Basic Resolved Signals, IEEE Std_Logic_1164 Resolved Subtypes, Resolved Signals andPorts, Resolved Signal Parameters.

UNIT – IV:

Generic Constants: Parameterizing Behavior, Parameterizing Structure.

Case Study: A Pipelined Multiplier Accumulator: Algorithm Outline, A Behavioral Model, A Register-Transfer-Level Model.

Reference Books:

1. The Designer's Guide to VHDL -By Peter J. Ashenden, 2nd Ed., 1stIndian Reprint, Harcourt India Pvt. Ltd.,2001.
2. VHDL Programming by Example – By Douglas L. Perry., 4th Ed., TMH., 2002.
3. Introductory VHDL : From Simulation to Synthesis –By Sudhakar Yalamanchili., Pearson Education Asia 2001
4. A VHDL Primer - By J.Bhasker ., Pearson Education Asia, 11th Indian Reprint, 2004.
5. Fundamentals of Digital Logic with VHDL Design - By Stephen Brown & ZvonkoVranesic., TMH. 2002
6. Digital Systems Design using VHDL by Charles H.Roth Jr., PWS Pub.,1998.
7. VHDL – Analysis & Modeling of Digital Systems – By Zainalabedin Navabi., 2nd Ed., MH., 1998.

Question paper pattern

Faculty of Science
Electronics
Title of the paper:
Paper:

Duration: 3Hrs] [Max. Marks : 80

Section-A: Short Answer Questions **(8 x 4 = 32)**
Answer any EIGHT questions

1. Unit – I
2. Unit – I
3. Unit – I (Problem)
4. Unit – II
5. Unit – II
6. Unit – II (Problem)
7. Unit – III
8. Unit – III
9. Unit – III (Problem)
10. Unit – IV
11. Unit – IV
12. Unit – IV (Problem)

Section B: Essay Answer Questions **(4 x 12 = 48)**

13 (a) Unit – I
OR
(b) Unit – I

14 (a) Unit – II
OR
(b) Unit – II

15 (a) Unit – III
OR
(b) Unit – III

16 (a) Unit – IV
OR
(b) Unit – IV

Department of Physics
Osmania University, Hyderabad

Proposed Scheme for B.Sc.,(Electronics)III-Year, Semester-VI under choice based credit system
Project Guidelines

Title: Project **5HPW-Credits- 4**

1. Number of students who will be offered the project work will vary from batch to batch depending upon the infrastructural facilities and may vary each year (Not exceeding 5 students per group)
2. Project work will involve Experimental work related to Electronics or any topic with allied subjects like Microcontroller based projects, IoT, Electronic Instrumentation, Medical Electronics, Communications etc., The student will have to complete this in the stipulated time.
3. The final evaluation of the project work will be assessed by a panel involving internal and external examiners as per the instructions the Examination branch, Osmania University.
4. Students will be asked their choice for project work at the beginning of 6^{th} semester and all formalities of topic and Guide selection will be completed within a week.
5. Project work will be offered in lieu of expertise and infrastructural facilities of the department and will be evaluated for 4 credits
6. The distribution of marks for the project work will be:
   Project work: 100 Marks (50 Marks for dissertation+ 25 Marks for research skills+25 Marks for research work Presentation)

Distribution of Hours

PROJECT PHASE - I 20 Hours

1. Project Group

Divide the students in to groups based on the project work. Each group should not have more than 5 students.

2. Guide Allocation

Any fulltime Physics/Electronics/Applied Electronics faculty (**Ratified by OU**) working in Osmania University Constituent/ Affiliated is eligible to guide the students. The number of students under a guide should not exceed 40 (8 batches). Guide can be from the same college or from different college. The faculty who are interested in guiding the students for projects should obtain formal approval from BoS, Electronics, Dept. of Physics, Osmania University.

For each group one guide is allocated and project topic should be selected based on the student interest and facilities available.

3. Weekly review of project work

Discussion with guide maintained in Project log book and project booklet.

4. Progress Monitoring

Pre-Seminar/s & Reviewing of First stage of Project work by Departmental Project Evaluation & Review committee (PERC)

PROJECT PHASE – II 30 Hours

5. Feedback & Suggestions

Given by Examiners are taken into account by Student

6. Participation in Project Based Events (Optional)

Project Exhibition, Poster Presentation, Paper Publication in Journals and Conferences etc.,

7. Pre-Exam Project Evaluation

Demonstration of working model in front of Internal Project Evaluation Committee (IPEC)

8. Submission of Project Report

Report in Prescribed format containing all event participation certificates

9. University Semester-VI Exam

Final evaluation of the project work will be through a panel involving internal and external examiners

Format for writing the Project Report

1. Title Page	**12.** Literature Survey
2. Certificate Page	**13.** Problem Statement
3. Certificate from Company (Sponsored if any) **4.** Index Page **5.** Abstract **6.** Acknowledgements **7.** List of Tables	**14.** Objectives **15.** Methodology **16.** Specifications of the System (if any) **17.** Results and Discussion **18.** References
8. List of Figures	**19.** Summary of the project and Paper Publications (if any)
9. List of Abbreviations	**20.** Hard copy of published paper at International Journal and Certificates
10. Outcome of the project **11.** Introduction (2-4 pages)	**21.** Field visit minutes of meeting and photo (if allowed) for sponsored projects **22.** CD must attached at the end of the report containing project demo video, presentation, project report, paper published, certificates

Yours Sincerely

Prof. J. Laxman Naik
Chairman, BoS in Electronics
Dept. of Physics
Osmania University, Hyd.

HEAD
Department of Physics
University College of Science
Osmania University,
Hyderabad-500 007. T.S.

Department of Physics
Osmania University, Hyderabad

Proposed Scheme for B.Sc.,(Electronics)III-Year, Semester-VI under choice based credit system

Project Guidelines

Title: Project **5HPW-Credits- 4**

1. Number of students who will be offered the project work will vary from batch to batch depending upon the infrastructural facilities and may vary each year (Not exceeding 5 students per group)
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   Project work: 100 Marks (50 Marks for dissertation+ 25 Marks for research skills+25 Marks for research work Presentation)

Distribution of Hours

PROJECT PHASE - I 20 Hours

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PROJECT PHASE – II 30 Hours

5. Feedback & Suggestions

Given by Examiners are taken into account by Student

6. Participation in Project Based Events (Optional)

Project Exhibition, Poster Presentation, Paper Publication in Journals and Conferences etc.,

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Report in Prescribed format containing all event participation certificates

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1. Title Page	12. Literature Survey
2. Certificate Page	13. Problem Statement
3. Certificate from Company (Sponsored if any)	14. Objectives
4. Index Page	15. Methodology
5. Abstract	16. Specifications of the System (if any)
6. Acknowledgements	17. Results and Discussion
7. List of Tables	18. References
8. List of Figures	19. Summary of the project and Paper Publications (if any)
9. List of Abbreviations	20. Hard copy of published paper at International Journal and Certificates
10. Outcome of the project	21. Field visit minutes of meeting and photo (if allowed) for sponsored projects
11. Introduction (2-4 pages)	22. CD must attached at the end of the report containing project demo video, presentation, project report, paper published, certificates

Yours Sincerely

Prof. J. Laxman Naik
Chairman, BoS in Electronics
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Osmania University, Hyd.

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Department of Physics
University College of Science
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Hyderabad-500 007, T.S.

OSMANIA UNIVERSITY
FACULTY OF SCIENCE
B.Sc. (Computer Science)
CBCS Pattern with Effect from the Academic Year 2019-2020

Structure of Curriculum

Course Title	Hours/Week		Credits
	Theory	Practical	
Semester –I			
Programming in C	4	3	4+1 = 5
Semester –II			
Programming in C++	4	3	4+1 = 5
Semester –III			
Data Structures using C++	4	3	4+1 = 5
Semester –IV			
Data Base Management Systems (DBMS)	4	3	4+1 = 5
Semester –V			
Programming in Java	4	3	4+1 = 5
Semester –VI			
Web Technologies	4	3	4+1 = 5

AECC		
	Hours/Week	Credits
Fundamentals of Computers	Theory 2	2
SEC		
Semester –III		
Communication Skills (or) Professional Skills (Sec –I)	2	2
Python –I (Sec –II)	2	2
Semester –IV		
Leadership & Management Skill (or) Universal Human Values (Sec –III)	2	2
Python –II (Sec –IV)	2	2
SEMESTER-V	**Generic Elective (GE)**	
Information Technologies	4	4
Project/Optional		
Semester –VI		
PHP with MY SQL	Theory 3 Practical 3	3+1=4

Prof.G.Kamala
Chairperson Board of Studies in Computer Science, OU

OSMANIA UNIVERSITY
FACULTY OF SCIENCE
B.Sc. (Computer Science)
SEMESTER – I
Programming in C

Theory	**4 Hours/Week**	**4 Credit**	**Internal marks = 20**
Practical	**3 Hours/Week**	**1 Credit**	**External Marks = 80**

Unit – I

Computer Fundamentals: Introduction of Computers, Classification of Computers, Anatomy of a Computer, Memory Hierarchy, Introduction to OS, Operational Overview of a CPU.
Program Fundamentals: Generation and Classification of Programming Languages, Compiling, Interpreting, Loading, Linking of a Program, Developing Program, Software Development.
Algorithms: Definitions, Different Ways of Stating Algorithms (Step-form, Pseudo-code, Flowchart), Strategy for Designing Algorithms, Structured Programming Concept.
Basics of C: Overview of C, Developing Programs in C, Parts of Simple C Program, Structure of a C Program, Comments, Program Statements, C Tokens, Keywords, Identifiers, Data Types, Variables, Constants, Operators and Expressions, Expression Evaluation–precedence and associativity, Type Conversions.

Unit – II

Input-Output: Non-formatted and Formatted Input and Output Functions, Escape Sequences,
Control Statements: Selection Statements – if, if-else, nested if, nested if-else, comma operator, conditional operator, switch; Iterative Statements–while, for, do-while; Special Control Statement–goto, break, continue, return, exit.
Arrays and Strings: One-dimensional Arrays, Character Arrays, Functions from ctype.h, string.h, Multidimensional Arrays.

Unit – III

Functions: Concept of Function, Using Functions, Call-by-Value Vs Call-by-reference, Passing Arrays to Functions, Score of Variables, Storage Classes, Inline Functions, and Recursion.
Pointers: Introduction, Address of Operator (&), Pointer, Uses of Pointers, Arrays and Pointers, Pointers and Strings, Pointers to Pointers, Array of Pointers, Pointer to Array, Dynamic Memory Allocation.

Unit – IV

User-defined Data Types: Declaring a Structure (Union) and its members, Initialization Structure (Union), Accessing members of a Structure (Union), Array of Structures (Union), Structures verses Unions, Enumeration Types.
Files: Introduction, Using Files in C, Working with Text Files, Working with Binary Files, Files of Records, Random Access to Files of Records, Other File Management Functions.

Textbook: Pradip Dey, Manas Ghosh, Computer Fundamentals and Programming in C (2e)
References:

1. Ivor Horton, Beginning C
2. Ashok Kamthane, Programming in C
3. Herbert Schildt, The Complete Reference C
4. Paul Deitel, Harvey Deitel, C How to Program
5. Byron S. Gottfried, Theory and Problems of Programming with C
6. Brian W. Kernighan, Dennis M. Ritchie, The C Programming Language
7. B. A. Forouzan, R. F. Gilberg, A Structured Programming Approach Using C

OSMANIA UNIVERSITY
FACULTY OF SCIENCE
B.Sc. (Computer Science)
SEMESTER – I

Programming in C Lab

Practical 3 Hours/Week 1 Credit Marks: 50

Note:

- Programs of all the Concepts from Text Book including exercises must be practice and execute.
- Faculty must take care about UG Standard Programs.
- In the external lab examination student has to execute two programs with compilation and deployment steps are necessary. Write the Pseudo Code and draw Flow Chart for the programs.
- Recommended to use Open Source Software: GCC on Linux; DevC++ (or) CodeBlocks on Windows10.
- External Vice-Voce is compulsory.

1. Write a program to find the largest two (three) numbers using if and conditional operator.
2. Write a program to print the reverse of a given number.
3. Write a program to print the prime number from 2 to n where n is given by user.
4. Write a program to find the roots of a quadratic equation using switch statement.
5. Write a program to print a triangle of stars as follows (take number of lines from user):

```
        *
      * * *
    * * * * *
  * * * * * * *
```

6. Write a program to find largest and smallest elements in a given list of numbers.
7. Write a program to find the product of two matrices.
8. Write a program to find the GCD of two numbers using iteration and recursion.
9. Write a program to illustrate the use of storage classes.
10. Write a program to demonstrate the call by value and the call by reference concepts.
11. Write a program that prints a table indicating the number of occurrences of each alphabet in the text entered as command line arguments.
12. Write a program to illustrate use of data type enum.
13. Write a program to demonstrate use of string functions string.h header file.
14. Write a program that opens a file and counts the number of characters in a file.
15. Write a program to create a structure Student containing fields for Roll No., Name, Class, Year and Total Marks. Create 10 students and store them in a file.
16. Write a program that opens an existing text file and copies it to a new text file with all lowercase letters changed to capital letters and all other characters unchanged.

OSMANIA UNIVERSITY
FACULTY OF SCIENCE
B.Sc. (Computer Science)
SEMESTER – II

Programming in C++

Theory	**4 Hours/Week**	**4 Credit**	**Internal marks = 20**
Practical	**3 Hours/Week**	**1 Credit**	**External Marks = 80**

Unit – I

Introduction to C++: Applications, Example Programs, Tokens, Data Types, Operators, Expressions, Control Structures, Arrays, Strings, Pointers, Searching and Sorting Arrays.
Functions: Introduction, Prototype, Passing Data by Value, Reference Variables, Using Reference Variables as Parameters, Inline Functions, Default Arguments, Overloading Functions, Passing Arrays to Functions.
Object Oriented Programming: Procedural and Object-Oriented Programming, Terminology, Benefits, OOP Languages, and OOP Applications.

Unit – II

Classes: Introduction, Defining an Instance of a Class, Why Have Private Members? Separating Class Specification from Implementation, Inline Member Functions, Constructors, Passing Arguments to Constructors, Destructors, Overloading Constructors, Private Member Functions, Arrays of Objects, Instance and Static Members, Friends of Classes, Member-wise Assignment, Copy Constructors, Operator Overloading, Object Conversion, Aggregation.

Unit – III

Inheritance: Introduction, Protected Members and Class Access, Base Class Access Specification, Constructors and Destructors in Base and Derived Classes, Class Hierarchies, Polymorphism-Function Overloading, Function Overriding and Virtual Member Functions, Abstract Base Classes and Pure Virtual Functions, Multiple Inheritance.
C++ Streams: Stream Classes, Unformatted I/O Operations, Formatted I/O Operations.

Unit – IV

Exceptions: Introduction, Throwing an Exception, Handling an Exception, Object-Oriented Exception Handling with Classes, Multiple Exceptions, Extracting Data from the Exception Class, Re-throwing an Exception.
Templates: Function Templates–Introduction, Function Templates with Multiple Type, Overloading with Function Templates, Class Templates – Introduction, Defining Objects of the Class Template, Class Templates and Inheritance, , Introduction to the STL.

Textbook: Tony Gaddis, Starting out with C++: from control structures through objects (7e)

References:

1. B. Lippman, C++ Primer
2. Bruce Eckel, Thinking in C++
3. K.R. Venugopal, Mastering C++
4. Herbert Schildt, C++: The Complete Reference
5. Bjarne Stroustrup, The C++ Programming Language
6. Sourav Sahay, Object Oriented Programming with C++TEXT BOOK:
7. Object Oriented Programming with C++ Sixth edition, E.Balaguruswamy.
8. A Structured Approach Using C++ By B.A.Forouzan & Rf Gilberg (Thomson Business Information India)
9. Herbert Schilbt, C++ - The Complete Reference, TMH 2002
10. J.P. Cohoon and J.W. Davidson, C++ program design – An Introduction To Programming and Object Oriented Design.- MGH 1999.

OSMANIA UNIVERSITY
FACULTY OF SCIENCE
B.Sc. (Computer Science)
SEMESTER – II

Programming in C++ Lab

Practical 3 Hours/Week 1 Credit Marks: 50

Note:

- Programs of all the Concepts from Text Book including exercises must be practice and execute.
- Faculty must take care about UG Standard Programs.
- In the external lab examination student has to execute two programs with compilation and deployment steps are necessary. Write the Pseudo Code and draw Flow Chart for the programs.
- Recommended to use Open Source Software: GCC on Linux; DevC++ (or) CodeBlocks on Windows10.
- External Vice-Voce is compulsory.

1. Write a program to.
    a. Print the sum of digits of a given number.
    b. Check whether the given number is Armstrong or not
    c. Print the prime number from 2 to n where n is natural number given.
2. Write a program to find largest and smallest elements in a given list of numbers and sort the given list.
3. Write a program to read the student name, roll no, marks and display the same using class and object.
4. Write a program to implement the dynamic memory allocation and de-allocation using new and delete operators using class and object.
5. Write a program to find area of a rectangle, circle, and square using constructors.
6. Write a program to implement copy constructor.
7. Write a program using friend functions and friend class.
8. Write a program to implement constructors
    a. Default Constructor, Parameterized Constructor, Copy Constructor
    b. Define the constructor inside/outside of the class
    c. Implement all three constructors within a single class as well as use multiple classes(individual classes)
9. Write a program to implement the following concepts using class and object
    a. Function overloading
    b. Operator overloading (unary/binary(+ and -))
10. Write a program to demonstrate single inheritance, multilevel inheritance and multiple inheritances.
11. Write a program to implement the overloaded constructors in inheritance.
12. Write a program to implement the polymorphism and the following concepts using class and object.
    a. Virtual functions
    b. Pure virtual functions
13. Write a program to implement the virtual concepts for following concepts
    a. Constructor (not applied)
    b. Destructor (applied)
14. Write a program to demonstrate static polymorphism using method overloading.
15. Write a program to demonstrate dynamic polymorphism using method overriding and dynamic method dispatch.
16. Write a program to implement the template (generic) concepts
    a. Without template class and object
    b. With template class and object

OSMANIA UNIVERSITY
FACULTY OF SCIENCE
B.Sc. (Computer Science)
SEMESTER – III
Data Structures using C++

Theory	**4 Hours/Week**	**4 Credit**	**Internal marks = 20**
Practical	**3 Hours/Week**	**1 Credit**	**External Marks = 80**

Unit - I

Basic data Structure: Introduction to Data Structures, Types of Data Structures, and Introduction to Algorithms, Pseudo code, and Relationship among data, data structures, and algorithms, Implementation of data structures, Analysis of Algorithms.
Stacks: Concept of Stacks and Queues, Stacks, Stack Abstract Data Type, Representation of Stacks Using Sequential Organization (Arrays), Multiple Stacks, Applications of Stack, Expression Evaluation and Conversion, Polish notation and expression conversion, Processing of Function Calls, Reversing a String with a Stack, Recursion.

Unit - II

Recursion: Introduction, Recurrence, Use of Stack in Recursion, Variants of Recursion, Recursive Functions, Iteration versus Recursion.
Queues: Concept of Queues, Queue as Abstract Data Type, Realization of Queues Using Arrays, Circular Queue, Multi-queues, Dequeue, Priority Queue, Applications of Queues,
Linked Lists: Introduction, Linked List, Linked List Abstract Data Type, Linked List Variants, Doubly Linked List, Circular Linked List, Representation of Sparse Matrix Using Linked List, Linked Stack, Linked Queue.

Unit - III

Trees: Introduction, Types of Trees, Binary Tree, Binary Tree Abstract Data Type, Realization of a Binary Tree, Insertion of a Node in Binary Tree, Binary Tree Traversal, Other Tree Operations, Binary Search Tree, Threaded Binary Tree, Applications of Binary Trees.
Searching and Sorting: Search Techniques-Linear Search, Binary Search, Sorting Techniques- Selection Sort, Bubble Sort, Insertion Sort, Merge Sort, Quick Sort, Comparison of All Sorting Methods, Search Trees: Symbol Table, Optimal Binary Search Tree, AVL Tree (Height-balanced Tree).

Unit - IV

Graphs: Introduction, Representation of Graphs, Graph Traversal – Depth First Search, Breadth First Search, Spanning Tree, Prim's Algorithm, Kruskal's Algorithm.
Hashing: Introduction, Key Terms and Issues, Hash Functions, Collision Resolution Strategies, Hash Table Overflow, Extendible Hashing
Heaps: Basic Concepts, Implementation of Heap, Heap as Abstract Data Type, Heap Sort, Heap Applications.

Text books:

1. Varsha H. Patil "Data structures using C++" Oxford University press, 2012
2. M.T. Goodrich, R. Tamassia and D. Mount, Data Structures and Algorithms in C++, John Wiley and Sons, Inc., 2011.

References:

1. Adam Drozdek “Data structures and algorithm in C++” Second edition, 2001
2. T.H. Cormen, C.E. Leiserson, R.L. Rivest and C. Stein, Introduction to Algorithms, 2nd Ed., Prentice-Hall of India, 2006.
3. Robert L. Kruse and A.J. Ryba, Data Structures and Program Design in C++, Prentice Hall, Inc., NJ, 1998.
4. B. Stroupstrup, The C++ Programming Language, Addison Wesley, 2004
5. D.E. Knuth, Fundamental Algorithms (Vol. I), Addison Wesley, 1997

OSMANIA UNIVERSITY
FACULTY OF SCIENCE
B.Sc. (Computer Science)
SEMESTER – III

Data Structures using C++ Lab

Practical 3 Hours/Week 1 Credit Marks: 50

Note:

- Programs of all the Concepts from Text Book including exercises must be practice and execute.
- In the external lab examination student has to execute two programs with compilation and deployment steps are necessary.
- External Vice-Voce is compulsory.

1. Write C++ programs to implement the following using an array
   a) Stack ADT b) Queue ADT
2. Write a C++ program to implement Circular queue using array.
3. Write C++ programs to implement the following using a single linked list.
   a) Stack ADT b) Queue ADT
4. Write a C++ program to implement Circular queue using Single linked list.
5. Write a C++ program to implement the double ended queue ADT using double linked list.
6. Write a C++ program to solve tower of Hanoi problem recursively
7. Write C++ program to perform the following operations:
   a) Insert an element into a binary search tree.
   b) Delete an element from binary search tree.
   c) Search for a key in a binary search tree.
8. Write C++ programs for the implementation tree traversal technique BFS.
9. Write a C++ program that uses recursive functions to traverse a binary search tree.
   a) Pre-order b) In-order c) Post-order
10. Write a C++ program to find height of a tree.
11 Write a C++ program to find MIN and MAX element of a BST.
12 Write a C++ program to find Inorder Successor of a given node.
13. Write C++ programs to perform the following operations on B-Trees and AVL Trees.
    a) Insertion b) Deletion
14 Write C++ programs for sorting a given list of elements in ascending order using the following sorting methods.
    a) Quick sort b) Merge sort
15. Write a C++ program to find optimal ordering of matrix multiplication.
16. Write a C++ program that uses dynamic programming algorithm to solve the optimal binary search tree problem
17. Write a C++ program to implement Hash Table
18. Write C++ programs to perform the following on Heap
    a) Build Heap b) Insertion c) Deletion
19. Write C++ programs to perform following operations on Skip List
    a) Insertion b) Deletion
20. Write a C++ Program to Create a Graph using Adjacency Matrix Representation.
21. Write a C++ program to implement graph traversal techniques
    a) BFS b) DFS
22. Write a C++ program to Heap sort using tree structure.

OSMANIA UNIVERSITY
FACULTY OF SCIENCE
B.Sc. (Computer Science)
SEMESTER – IV

Data Base Management Systems

Theory 4 Hours/Week 4 Credit Internal marks = 20
Practical 3 Hours/Week 1 Credit External Marks = 80

Unit - I

Introduction: Database-System Applications, Purpose of Database Systems, View of Data, Database Languages, Relational Databases, Database Design, Data Storage and Querying, Transaction Management, Database Architecture, Database Users and Administrators.
Introduction to the Relational Model: Structure of Relational Databases, Database Schema, Keys, Schema Diagrams, Relational Query Languages, Relational Operations.

Unit - II

Database Design and the E-R Model: Overview of the Design Process, The Entity-Relationship Model, Constraints, Removing Redundant Attributes in Entity Sets, Entity-Relationship Diagrams, Reduction to Relational Schemas, Entity-Relationship Design Issues, Extended E-R Features, Alternative Notations for Modeling Data, Other Aspects of Database Design.
Relational Database Design: Features of Good Relational Designs, Atomic Domains and First Normal Form, Decomposition Using Functional Dependencies, Functional- Dependency Theory, Decomposition Using Multivalued Dependencies, Normal Forms-2 NF, 3 NF, BCNF, The Database Design Methodology for Relational Databases.

Unit - III

Introduction to SQL: Overview of the SQL Query Language, SQL Data Definition, Basic Structure of SQL Queries, Additional Basic Operations, Set Operations, Null Values, Aggregate Functions, Nested Subqueries , Modification of the Database.
Intermediate SQL: Join Expressions, Views, Transactions, Integrity Constraints, SQL Data Types and Schemas, Authorization.
Advanced SQL: Accessing SQL from a Programming Language, Functions and Procedures, Triggers, Recursive Queries.

Unit - IV

Transaction Management: Transaction Support–Properties of Transactions, Database Architecture, Concurrency Control–The Need for Concurrency Control, Serializability and Recoverability, Locking Methods, Deadlock, Time Stamping Methods, Multi-version Timestamp Ordering, Optimistic Techniques, Granularity of Data Items, Database Recovery–The Need for Recovery, Transactions and Recovery, Recovery Facilities, Recovery Techniques, Nested Transaction Model. Security: Database Security–Threats, Computer-Based Controls–Authorization, Access Controls, Views, Backup and Recovery, Integrity, Encryption, RAID.

Text book:

1. Silberschatz, H. Korth and S. Sudarshan, Database System Concepts, 6th Ed., Tata McGraw Hill, 2011
2. Thomas M. Connolly, Carolyn E. Begg, Database Systems–A Practical Approach to Design, Implementation, and Management (6e)

OSMANIA UNIVERSITY
FACULTY OF SCIENCE
B.Sc. (Computer Science)
SEMESTER – IV

Data Base Management Systems Lab

Practical 3 Hours/Week 1 Credit Marks: 50

Note:

- Programs of all the Concepts from Text Book including exercises must be practice and execute.
- In the external lab examination student has to execute two programs with compilation and deployment steps are necessary.
- External Vice-Voce is compulsory.

1. Create a database having two tables with the specified fields, to computerize a library system of a University College.
   LibraryBooks (Accession number, Title, Author, Department, PurchaseDate, Price), IssuedBooks (Accession number, Borrower)

   a) Identify primary and foreign keys. Create the tables and insert at least 5 records in each table.
   b) Delete the record of book titled "Database System Concepts".
   c) Change the Department of the book titled "Discrete Maths" to "CS".
   d) List all books that belong to "CS" department.
   e) List all books that belong to "CS" department and are written by author "Navathe".
   f) List all computer (Department="CS") that have been issued.
   g) List all books which have a price less than 500 or purchased between "01/01/1999" and "01/01/2004".

2. Create a database having three tables to store the details of students of Computer Department in your college.
   Personal information about Student (College roll number, Name of student, Date of birth, Address, Marks(rounded off to whole number) in percentage at 10 + 2, Phone number)
   Paper Details (Paper code, Name of the Paper)
   Student's Academic and Attendance details (College roll number, Paper Code, Attendance, Marks in home examination).

   a) Identify primary and foreign keys. Create the tables and insert at least 5 records in each table.
   b) Design a query that will return the records (from the second table) along with the name of student from the first table, related to students who have more than 75% attendance and more than 60% marks in paper2.
   c) List all students who live in "Warangal" and have marks greater than 60 in paper1.
   d) Find the total attendance and total marks obtained by each student.
   e) List the name of student who has got the highest marks in paper2.

3. Create the following tables and answer the queries given below:
   Customer (CustID, email, Name, Phone, ReferrerID)
   Bicycle (BicycleID, DatePurchased, Color, CustID, ModelNo)
   BicycleModel(ModelNo, Manufacturer, Style)
   Service (StartDate, BicycleID, EndDate)

a) Identify primary and foreign keys. Create the tables and insert at least 5 records in each table.
b) List all the customers who have the bicycles manufactured by manufacturer "Honda".
c) List the bicycles purchased by the customers who have been referred by Customer "C1".
d) List the manufacturer of red colored bicycles.
e) List the models of the bicycles given for service.

4. Create the following tables, enter at least 5 records in each table and answer the queries given below.
Employee (Person_Name, Street, City)
Works (Person_Name, Company_Name, Salary)
Company (Company_Name, City)
Manages (Person_Name, Manager_Name)

a) Identify primary and foreign keys.
b) Alter table employee, add a column "email" of type varchar(20).
c) Find the name of all managers who work for both Samba Bank and NCB Bank.
d) Find the names, street address and cities of residence and salary of all employees who work for "Samba Bank" and earn more than $10,000.
e) Find the names of all employees who live in the same city as the company for which they work.
f) Find the highest salary, lowest salary and average salary paid by each company.
g) Find the sum of salary and number of employees in each company.
h) Find the name of the company that pays highest salary.

5. Create the following tables, enter at least 5 records in each table and answer the queries given below.
Suppliers (SNo, Sname, Status, SCity)
Parts (PNo, Pname, Colour, Weight, City)
Project (JNo, Jname,Jcity)
Shipment (Sno, Pno, Jno, Qunatity)

a) Identify primary and foreign keys.
b) Get supplier numbers for suppliers in Paris with status>20.
c) Get suppliers details for suppliers who supply part P2. Display the supplier list in increasing order of supplier numbers.
d) Get suppliers names for suppliers who do not supply part P2.
e) For each shipment get full shipment details, including total shipment weights.
f) Get all the shipments where the quantity is in the range 300 to 750 inclusive.
g) Get part nos. for parts that either weigh more than 16 pounds or are supplied by suppliers S2, or both.
h) Get the names of cities that store more than five red parts.
i) Get full details of parts supplied by a supplier in Hyderabad.
j) Get part numbers for part supplied by a supplier in Warangal to a project in Chennai.
k) Get the total number of project supplied by a supplier (say, S1).
l) Get the total quantity of a part (say, P1) supplied by a supplier (say, S1).

6. Write a PL/SQL Program to demonstrate Procedure.
7. Write a PL/SQL Program to demonstrate Function.

8. Write a PL/SQL program to Handle Exceptions.
9. Write a PL/SQL Program to perform a set of DML Operations.
10. Create a View using PL/SQL program.
11. Write a PL/SQL Program on Statement Level Trigger.
12. Write a PL/SQL Program on Row Level Trigger.

OSMANIA UNIVERSITY
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B.Sc. (Computer Science)
SEMESTER – V
Programming in Java

Theory	**4 Hours/Week**	**4 Credit**	Internal marks = 20
Practical	**3 Hours/Week**	**1 Credit**	External Marks = 80

Unit - I
Introduction: Java Essentials, JVM, Java Features, Creation and Execution of Programs, Data Types, Structure of Java Program, Type Casting, Conditional Statements, Loops, Classes, Objects, Class Declaration, Creating Objects.

Unit - II
Method Declaration and Invocation, Method Overloading, Constructors – Parameterized Constructors, Constructor Overloading, Cleaning-up unused Objects. Class Variables &Method-static Keyword, this Keyword, One-Dimensional Arrays, Two-Dimensional Arrays, Command-Line Arguments, Inner Class.
Inheritance: Introduction, Types of Inheritance, extends Keyword, Examples, Method Overriding, super, final Keyword, Abstract classes, Interfaces, Abstract Classes Verses Interfaces.
Packages: Creating and Using Packages, Access Protection, Wrapper Classes, String Class, StringBuffer Class.

Unit - III
Exception: Introduction, Types, Exception Handling Techniques, User-Defined Exception.
Multithreading: Introduction, Main Thread and Creation of New Threads –By Inheriting the Thread Class or Implementing the Runnable Interface, Thread Lifecycle, Thread Priority and Synchronization.
Input/Output: Introduction, java.io Package, File Streams, FileInputStream Class, FileOutputStream Class, Scanner Class, BufferedInputStream Class, BufferedOutputStream Class, RandomAccessFile Class.

Unit - IV
Applets: Introduction, Example, Life Cycle, Applet Class, Common Methods Used in Displaying the Output (Graphics Class).
Event Handling: Introduction, Types of Events, Example.
AWT: Introduction, Components, Containers, Button, Label, Checkbox, Radio Buttons, Container Class, Layouts.
Swings: Introduction, Differences between Swing and AWT, JFrame, JApplet, JPanel, Components in Swings, Layout Managers, JTable.

Text Book:

1. Sachin Malhotra, Saurabh Choudhary, Programming in Java (2e)

References:

1. Bruce Eckel, Thinking in Java (4e)
2. Herbert Schildt, Java: The Complete Reference (9e)
3. Y. Daniel Liang, Introduction to Java Programming (10e)
4. Paul Deitel, Harvey Deitel, Java: How To Program (10e)
5. Cay S. Horsttnann, Core Java Volume I –Fundamentals (10e)

OSMANIA UNIVERSITY
FACULTY OF SCIENCE
B.Sc. (Computer Science)
SEMESTER – V

Programming in Java Lab

Practical 3 Hours/Week 1 Credit Marks: 50

Note:

- Programs of all the Concepts from Text Book including exercises must be practice and execute.
- In the external lab examination student has to execute two programs with compilation and deployment steps are necessary.
- External Vice-Voce is compulsory.

1. Write a program to find the largest of n natural numbers.
2. Write a program to find whether a given number is prime or not.
3. Write a menu driven program for following:
    a. Display a Fibonacci series
    b. Compute Factorial of a number
4. Write a program to check whether a given number is odd or even.
5. Write a program to check whether a given string is palindrome or not.
6. Write a program to print the sum and product of digits of an Integer and reverse the Integer.
7. Write a program to create an array of 10 integers. Accept values from the user in that Array. Input another number from the user and find out how many numbers are equal to the number passed, how many are greater and how many are less than the number passed.
8. Write a program that will prompt the user for a list of 5 prices. Compute the average of the prices and find out all the prices that are higher than the calculated average.
9. Write a program in java to input N numbers in an array and print out the Armstrong numbers from the set.
10. Write java program for the following matrix operations:
    a. Addition of two matrices
    b. Transpose of a matrix
11. Write a java program that computes the area of a circle, rectangle and a Cylinder using function overloading.
12. Write a Java program for the implementation of multiple inheritance using interfaces to calculate the area of a rectangle and triangle.
13. Write a java program to create a frame window in an Applet. Display your name, address and qualification in the frame window.
14. Write a java program to draw a line between two coordinates in a window.
15. Write a java program to display the following graphics in an applet window.
    a. Rectangles b. Circles
    c. Ellipses d. Arcs e. Polygons
16. Write a program that reads two integer numbers for the variables a and b. If any other character except number (0-9) is entered then the error is caught by NumberFormatException object. After that ex.getMessage () prints the information about the error occurring causes.
17. Write a program for the following string operations:
    a. Compare two strings b. concatenate two strings c. Compute length of a string
18. Create a class called Fraction that can be used to represent the ratio of two integers. Include appropriate constructors and methods. If the denominator becomes zero, throw and handle an exception.

OSMANIA UNIVERSITY
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B.Sc. (Computer Science)
SEMESTER – VI
Web Technologies

Theory	**4 Hours/Week**	**4 Credit**	**Internal marks = 20**
Practical	**3 Hours/Week**	**1 Credit**	**External Marks = 80**

Unit – I
Introduction To XHTML– Introduction, first HTML, Headings, Linking, Images, special characters and horizontal rules, Lists, Tables, Frames, Forms, internal linking, meta Elements. CASCADING STYLE SHEETS – Introduction, Inline Styles, Embedded Style Sheets, Conflicting Styles, Linking external sheets, position Elements, box model and text flow, media types, building a CSS drop-down menu, user style sheets, CSS3.

Unit – II
Introduction To Java Scripting- introduction, simple program, prompt dialog and alert boxes, memory concepts, operators, decision making, control structures, if… else statement, while, counter-controlled repetitions, switch statement, do… while statement, *break* and *continue* statements. Functions – program modules in JavaScript, programmer–defined functions, functions definition, scope rules, global functions, Recursion.

Unit – III
Arrays- introduction, declaring and allocating arrays, references and reference parameters, passing arrays to functions. Multidimensional arrays, **EVENTS** – registering event handling, event onload, onmouseover, onmouseout, onfocus, onblur, onsubmit, onreset, event bubbling, more events. **JAVA SCRIPT OBJECTS** – introduction to object technology, Math Object, String Object, Date Object, Boolean and Number Object, document and window Objects, using cookies.

Unit – IV
XML - Introduction, XML Basics, Structuring Data, XML Namespaces, Document Type Definitions (DTDs), W3C XML Schema Documents, XML Vocabularies, Extensible Style sheet Language and XSL Transformations, Document Object Model (DOM).

Ajax-Enabled Rich Internet Applications: introduction, history of Ajax, traditional web applications Vs Ajax Applications, RIAs with Ajax, Ajax example using XMLHttpRequest object, XML and DOM, creating full scale Ajax-enabled application, Dojo Toolkit.

Text Book:
1. Internet & World Wide Web: HOW TO PROGRAM- H. M. Deitel, P.J. Deitel, - Fourth Edition- Pearson edition.

OSMANIA UNIVERSITY
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SEMESTER – VI

Web Technologies Lab

Practical 3 Hours/Week 1 Credit Marks: 50

1. Write a HTML program using basic text formatting tags, <p>, <br>, <pre>.
2. Write a HTML program by using text formatting tags.
3. Write a HTML program using presentational element tags <b>, <i>, <strike>, <sup>, <sub>, <big>, <small>, <hr>
4. Write a HTML program using phrase element tags <blockquote>, <cite>, <abbr>, <acronym>, <kbd>, <address>
5. Write a HTML program using different list types.
6. Create a HTML page that displays ingredients and instructions to prepare a recipe.
7. Write a HTML program using grouping elements and .
8. Write a HTML Menu page for Example cafe site.
9. Write a HTML program using images, audios, videos.
10. Write a HTML program to create your time table.
11. Write a HTML program to create a form using text inputs, password inputs, multiple line text input, buttons, check boxes, radio buttons, select boxes, file select boxes.
12. Write a HTML program to create frames and links between frames.
13. Write a HTML program to create different types of style sheets.
14. Write a HTML program to create CSS on links, lists, tables and generated content.
15. Write a HTML program to create your college web site using multi column layouts.
16. Write a HTML program to create your college web site using for mobile device.
17. Write a HTML program to create login form and verify username and password.
18. Write a JavaScript program to calculate area of rectangle using function.
19. Write a JavaScript program to wish good morning, good afternoon, good evening depending on the current time.
20. Write a JavaScript program using switch case?
21. Write a JavaScript program to print multiplication table of given number using loop.
22. Write a JavaScript programs using any 5 events.
23. Write a JavaScript program using JavaScript built in objects.
24. Write a JavaScript program to create registration Form with Validations.
25. Write a XML Program to represent Student Data using DTD.
26. Write a XML Program to represent Data using XML Schema Definition.

OSMANIA UNIVERSITY
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B.Sc. Computer Science
Semester-I
AECC

Fundamentals of Computers

Theory **2 Hours/Week** **2Credits**

Unit-I

Introduction to Computers: what is a computer, characteristics of Computers, Generations of Computers, Classifications of Computers, Basic Computer organization, Applications of Computers. Input and Output Devices: Input devices, Output devices, Softcopy devices, Hard copy devices. Computer Memory and Processors: Introduction, Memory Hierarchy, Processor, Registers, Cache memory, primary memory, secondary storage devices, magnetic tapes, floppy disks, hard disks, optical drives, USB flash drivers, Memory cards, Mass storage devices, Basic processors architecture.

Unit-II

Number System and Computer Codes: Binary number system, working with binary numbers, octal number system, hexadecimal number system, working with fractions, signed number representation in binary form, BCD code, other codes. Boolean algebra and logic gates: Boolean algebra, Venn diagrams, representation of Boolean functions, logic gates, logic diagrams and Boolean expressions using karnaugh map. Computer Software: Introduction to computer software, classification of computer software, system software, application software, firmware, middleware, acquiring computer software, design and implementation of correct, efficient and maintainable programs.

Text Book:

Reema Thareja, Fundamentals of Computers.

References:

1. V.Rajaraman, 6th Edition Fundamentals of Computers, Neeharika Adabala.
2. Anita Goel, Computer Fundamentals.

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.

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SEMESTER – III

Python – I

(SEC – II)

Theory **2 Hours/Week** **2Credits**

Unit – I

Introduction to Python Programming: How a Program Works, Using Python, Program Development Cycle, Input, Processing, and Output, Displaying Output with the Print Function, Comments, Variables, Reading Input from the Keyboard, Performing Calculations (Operators. Type conversions, Expressions), More about Data Output. Decision Structures and Boolean Logic: if, if-else, if-elif-else Statements, Nested Decision Structures, Comparing Strings, Logical Operators, Boolean Variables. Repetition Structures: Introduction, while loop, for loop, Calculating a Running Total, Input Validation Loops, Nested Loops.

Unit – II

Functions: Introduction, Defining and Calling a Void Function, Designing a Program to Use Functions,

Local Variables, Passing Arguments to Functions, Global Variables and Global Constants, Value-Returning Functions- Generating Random Numbers, Writing Our Own Value-Returning Functions, The math Module, Storing Functions in Modules. File and Exceptions: Introduction to File Input and Output, Using Loops to Process Files, Processing Records, Exceptions.

Text Book:

Tony Gaddis, Starting Out With Python (3e)

References:

1. Kenneth A. Lambert, Fundamentals of Python
2. Clinton W. Brownley, Foundations for Analytics with Python
3. James Payne, Beginning Python using Python 2.6 and Python 3
4. Charles Dierach, Introduction to Computer Science using Python
5. Paul Gries, Practical Programming: An Introduction to Computer Science using Python 3

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.

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SEMESTER – IV
Python – II
(SEC – IV)

Theory **2 Hours/Week** **2Credits**

Unit – I

Lists and Tuples: Sequences, Introduction to Lists, List slicing, Finding Items in Lists with the in Operator, List Methods and Useful Built-in Functions, Copying Lists, Processing Lists, Two-Dimensional Lists, Tuples. Strings: Basic String Operations, String Slicing, Testing, Searching, and Manipulating Strings. Dictionaries and Sets: Dictionaries, Sets, Serializing Objects.
Recursion: Introduction, Problem Solving with Recursion, Examples of Recursive Algorithms.

Unit – II

Object-Oriented Programming: Procedural and Object-Oriented Programming, Classes, Working with Instances, Techniques for Designing Classes, Inheritance, Polymorphism.
GUI Programming: Graphical User Interfaces, Using the tkinter Module, Display text with Label Widgets, Organizing Widgets with Frames, Button Widgets and Info Dialog Boxes, Getting Input with Entry Widget, Using Labels as Output Fields, Radio Buttons, Check Buttons.

Text Book:

Tony Gaddis, Starting Out With Python (3e)

References:

1. Kenneth A. Lambert, Fundamentals of Python
2. Clinton W. Brownley, Foundations for Analytics with Python
3. James Payne, Beginning Python using Python 2.6 and Python 3
4. Charles Dierach, Introduction to Computer Science using Python
5. Paul Gries, Practical Programming: An Introduction to Computer Science using Python 3

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SEMESTER – V
Information Technologies
(General Elective)

Theory **4 Hours/Week** **4Credits**

Unit – I

Computer Networks: Introduction, Connection Media, Data Transmission Mode, Data Multiplexing, Data Switching, Network Topologies, Types of Networks, Networking Devices, OSI Model.
The Internet: Internet Services, Types of Internet Connections, Internet Security.

Unit – II

Introduction to Emerging Computer Technologies: Distributed Networking, Peer-to-peer Computing, Grid Computing, Cloud Computing, Utility Computing, On-demand Computing, Wireless Network, Bluetooth, Artificial Intelligence.

Unit – III

Email, Functions of Email, Browser, Web Browser, Internet Service Providers.
Introduction to Information Security – Need for Information Security, Threats to Information Systems, Information Assurance, Cyber Security.

Unit – IV

Introduction to Application Security and Counter Measures – Introduction to Application Security, Data Security Considerations, Security Technologies, Security Threats, Security Threats to E-Commerce, E-Cash and Electronic Payment System.

Text Books:

Dr. Surya Prakash T, Ritendra G, Praveen Kumar S, KLSI, Introduction to Information Security and Cyber Laws (Dreamtech Publication)

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SEMESTER – VI

PHP with MY SQL

(PROJECT/Optional)

Theory	**3 Hours/Week**	**3 Credit**	**Internal marks = 15**
Practical	**3 Hours/Week**	**1 Credit**	**External Marks = 60**

Unit – I

Introducing PHP – What is PHP? Why use PHP? Evolution of PHP, Installing PHP, Other ways to run PHP, Creating your first script. PHP Language Basics – Using variables, Understanding Data Types, Operators and Expressions, Constants. Decisions and Loops – Making Decisions, Doing Repetitive Tasks with Looping, Mixing Decisions and Looping with HTML. Strings – Creating and Accessing Strings, Searching Strings, Replacing Text with Strings, Dealing with Upper and Lowercase, Formatting Strings. Arrays – Creating Arrays, Accessing Array Elements, Looping through Arrays with for-each, Creating Function, Reading Data in Web pages: setting up web pages to communicate with PHP, Handling Text Fields, Text Areas, Checkboxes, Radio Buttons, List Boxes, Password Controls, Image Maps, File Uploads, Buttons, and PHP Browser.

Unit – II

Object oriented programming: creating Classes and objects, setting access to properties and methods, constructors, destructors, Inheritance, overriding and overloading methods, auto loading classes. Advanced OOP: Static members and inheritance, Abstract classes, Interfaces, object iteration, comparing objects, class constants, final keyword, reflection.
File Handling: fopen, feof, fgets, closing a file, fgetc, file_get_contents, reading a file into an array with file, file_exists, filesize, fread, fscanf, parse_ini_file, stat, fseek, copy, unlink, fwrite, reading and writing binary files, appending a file, file_put_contents, locking files

Unit – III

Introducing Databases and SQL – Deciding How to Store Data, Understanding Relational Databases, Setting Up MySQL, A Quick Play with MySQL, Connecting MySQL from PHP. Retrieving Data from MySQL with PHP, Retrieving Data with SELECT, Creating a Member Record Viewer. Manipulating MySQL Data with PHP – Inserting, Updating, and Deleting Records, Building a Member Registration Application. Sessions, Cookies and FTP.

Text Books:

1. Steven Holzner, "PHP: The Complete Reference Paperback", McGraw Hill Education (India), 2007.
2. Timothy Boronczyk, Martin E. Psinas, "PHP and MYSQL (Create-Modify-Reuse)", Wiley India Private Limited, 2008.

Project work

Theory: 4 Hours/Week Credits: 4

- The total allotted marks 100 are divided in to 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 for10 minutes followed by 05 minutes for discussion.
- The student should submit a technical write-up on the project.

At least two teachers will be associated with the project seminar to evaluate students for the award of sessional marks which will be on the basis of performance in all the 3 items (synopsis, presentation, technical write-up).

Dissertation	50M
Presentation	15M
Viva	15M

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SEMESTER – VI

PHP with MY SQL Lab

Practical 3 Hours/Week 1 Credit Marks: 25

Note:

- Programs of all the Concepts from Text Book including exercises must be practice and execute.
- External Vice-Voce is compulsory.

1. Write a PHP script to display the Fibonacci sequence with HTML page.
2. Write a PHP script to create a chess board.
3. Write a PHP script using built-in string function like strstr(), strops(), substr_count(), etc...
4. Write a PHP script to transform a string to uppercase, lowercase letters, make a string's first Character uppercase.
5. Write a PHP script to count number of elements in an array and display a range of array elements.
6. Write a PHP script using a function to display the entered string in reverse.
7. Write a PHP script to demonstrate inheritance.
8. Write a PHP script to demonstrate the object overloading with _get(), _set(), and _call().
9. Write a PHP script to demonstrate the method overloading and method overriding mechanisms.
10. Write a PHP script to demonstrate the use of final classes and final methods.
11. Write a PHP script to demonstrate the use of interfaces.
12. Write a PHP script using constructors and destructors.
13. Write a PHP application to handling HTML forms with PHP script.
14. Write a PHP script to create a file, write data into file and display the file's data.
15. Write a PHP script to check and change file permissions, copying, renaming and deleting files.
16. Write a PHP application for connecting to MySQL and reading data from database table.
17. Write a PHP application for inserting, updating, deleting records in the database table.
18. Develop a PHP application for student registration form.
19. Develop a PHP application for creating, updating, reading and deleting the Student records from MYSQL Database.

OSMANIA UNIVERSITY
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UG (B.Sc.) Scheme of Examinations

B.Sc. (Computer Science)

(CBCS 2019-2020)

Elaborations

Paper	Credits	Theory Exam		Practical Exam
		University Exam	Internal Exam	
DSC	4+1	80 Marks	20 Marks	50 Marks
DSE	4+1	80 Marks	20 Marks	50 Marks
SEC	2	40 Marks	10 Marks	No Practical
GE	4	80 Marks	20 Marks	No Practical
AECC	2	40 Marks	10 Marks	No Practical
PO	3+1	60 Marks	15 Marks	25 Practical

DSC – Discipline specific core course

DSE – Discipline specific elective course

SEC – Skill enhancement course

GE – Generic Elective

AECC - Ability Enhancement Compulsory

P/O -Project/Optional

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Model Question Paper

3 Hours Max Marks -80 Credits -4

PART -A **Answer any eight questions in part –A 8X4 M = 32 Marks**

UNIT- I 1
2
3

UNIT- II 4
5
6

UNIT- III 7
8
9

UNIT- IV 10
11
12

Part – B **Answer all Questions 12MX4 = 48 Marks**

UNIT- I 13
Or
14

UNIT- II 15
Or
16

UNIT- III 17
Or
18

UNIT- IV 19
Or
20

With Effect from the Academic Year 2019-2020

OSMANIA UNIVERSITY
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Internal Exam (Theory)

Time: 1 Hr. ***Maximum marks: 20***

- Two internal exams (one at the middle of the semester and the other at the end) of one-hour duration are to be conducted carrying 15 marks each.
- Average of the scores of two exams should be taken into account.
- Following is the examination pattern.
  - 10 MCQs (multiple choice questions) of half mark each,
  - 10 FIBs (Fill in the Blanks) of half mark each
  - 5 SAQs (short answered questions) of one mark each
  - Totaling 15 marks.
  - 5 marks meant for assignment.

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Practical Question Paper

3 Hours Max Marks -50 Credits -1

Answer any Two 15X 2 = 30 MARKS

UNIT – I	1 Program
UNIT- II	1 Program
UNIT-III	1 Program
UNIT-IV	1 Program

Viva - 10 Marks

Record – 10 Marks

With Effect from the Academic Year 2019-2020

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2 Credit (SEC) Paper

University Exam (Theory)

Time: 2 Hrs. ***Maximum marks: 40***

Section – A (4 X 4M = 16 Marks)

Answer any four of the following six questions. Each carries four marks.

Q1. From Unit 1
Q2. From Unit 1
03. From Unit 1
Q4. From Unit 2
Q5. From Unit 2
06. From Unit 2

Section – B (2 X 12M = 24 Marks)

Answer all the following two questions. Each carries fifteen marks.

Q09. (a) or (b) from Unit 1
Q10. (a) or (b) from Unit 2

Internal Exam (Theory)

Time: 1/ 2 Hr. ***Maximum marks: 10***

- One internal exam at the end of the semester, of half an hour duration is to be conducted carrying 10 marks.
- Following is the examination pattern.
  - 10 MCQs (multiple choice questions) of one mark each,
    No assignment is required.

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B.Sc. (Computer Science)
Model Question Paper for Semester VI Project/optional only

3 Hours Max Marks -60 Credits -3

PART -A **Answer any Six questions in part –A 6X4 M = 24 Marks**

UNIT- I 1
2
3

UNIT- II 4
5
6

UNIT- III 7
8
9

Part – B **Answer all Questions 12MX3 = 36 Marks**

UNIT- I 13
Or
14

UNIT- II 15
Or
16

UNIT- III 17
Or
18

Internal Exam for Semester VI (Project /optional) (Theory)

Time: 1 Hr. ***Maximum marks: 15***

- Two internal exams (one at the middle of the semester and the other at the end) of one-hour duration are to be conducted carrying 15 marks each.
- Average of the scores of two exams should be taken into account.
- Following is the examination pattern.
  - 10 MCQs (multiple choice questions) of half mark each,
  - 10 FIBs (Fill in the Blanks) of half mark each
  - 5 SAQs (short answered questions) of one mark each
  - Totaling 15 marks.
  - No assignment required.

OSMANIA UNIVERSITY
FACULTY OF SCIENCE
B.Sc. (Computer Science)

Practical Question Paper for Project/ Optional

3 Hours Max Marks -25 Credits -1

Answer any Two 6X 2 = 12 MARKS

UNIT – I	1 Program
UNIT- II	1 Program
UNIT-III	1 Program

Viva - 8 Marks

Record – 5 Marks

With Effect from the Academic Year 2019-2020

MOOCs [Massive Online Open Courses] **Free Resources**

E-Learning:

▪ NPTEL	:nptel.ac.in	[Core Subjects Certification]
▪ C++ INSTITUTE	:cppinstitute.org	[C++ Certification]
▪ ORACLEEDUCATION	:education.oracle.com	[Java, DBMS Certification]
▪ BIG DATA UNIVERSITY	:bigdatauniversity.com	[Big Data Certification]
▪ COURSERA	:coursera.org	[Core Subjects Certification]
▪ CODEACADEMY	:codecademy.com	[Coding Certification]
▪ KHANACADEMY	:khanacademy.org	[Core Subjects Certification]
▪ PIXAR IN A BOX	:khanacademy.org/partner-content/pixar	
▪ VIDEOLECTURES	:videolectures.net	
▪ YOUTUBEEDU	:plus.google.com/+YouTubeEDU/posts	
▪ DISNEY RESEARCH	:disneyresearch.com	
▪ ALISON	:alison.com	[Core Subjects Certification]
▪ INTERNET ARCHIVE	:archive.org	

Freeware:

▪ SCILAB	: scilab.org	[MatLab Equivalent]
▪ GEOGEBRA	:geogebra.org	[Software for Class Room Teaching]

Search Engine:

▪ WOLFRAM ALPHA	:wolframalpha.com	[Computing Engine]
▪ CITESEER	:citeseerx.ist.psu.edu	[Searching Research Articles]
▪ DOAJ	:doaj.org	[Open Access to Journals]