Course curriculum for B.Tech. 2022 Batch for Autumn Semester 2022-23 (Common for all)

Semester I (2022 Batch)				
Serial no.	**Course code**	**Course name**	**Credits**	**Course Instructor**
1	CH 102	Fundamental concepts and applications of chemistry	6	Prof. B L Tembe Prof. Rajeswara Rao Prof. Nilkamal Mahanta
2	PH 101	Quantum physics and Applications	6	Prof. Santosh Kumar
3	CS 103	Introduction to Programming - 1 (IP-1) (Using C) (1st Half Semester)	4	Prof. Ramachandra Phawade Prof. Nikhil Hegde
4	EE 103	Introduction to Programming - 2 (IP-2) (Using Python) (2nd Half Semester)	4	Prof. B.N. Bharath
5	BB 103	Introduction to Modern Biology	6	Prof. Sudhanshu Shukla Prof. Surya Pratap Singh
6	MA 109	Calculus-I (1st Half Semester)	4	Prof. Amlan K Barua
7	MA 121	Calculus-II (2nd Half Semester)	4	Prof. Sagnik Sen
8	HS 103	Introduction to Fine Arts (IFA)	P/NP	Prof. Jolly Thomas (Co-ordinator)
9	HS 106	Design Thinking and Creativity (DT&C)	P/NP	Prof. Pradeep Y.
10	PH 113	Hands-on Science Laboratory –I (HSL)	3	Prof. Rajeswara Rao Prof. Nilkamal Mahanta Prof. Sudhanshu Shukla Prof. Surya Pratap Singh Prof. R Prabhu Prof. Kavita Devi Prof. Koushik Saha Prof. Santhosh Kumar
11	NO 103	NSO/NSS	P/NP	Mr. Ravi Galimath Mr. G Ramesh Dr. Keerthi Kumar
Total credits			**37**	

SYLLABUS

Name of Academic Unit: Chemistry
Level: B.Tech.
Programme: B.Tech.

i	**Title of the course**	CH 102 Fundamental aspects and applications of chemistry
ii	**Credit Structure (L-T-P-C)**	(3-0-0-6)
iii	**Type of Course**	Core course
iv	**Semester in which normally to be offered**	Autumn
v	**Whether Full or Half Semester**	Full
vi	**Pre-requisite(s), if any (For the students) – *specify course***	--
vii	**Course Content**	**Organic and Inorganic (Inorganic): a. Harness the power of periodic table** Periodic properties: trends in size, electron affinity, ionization potential and electronegativity • Role of chemical elements in water contamination • Hardness of water • Desalination of brackish and sea water • Role of silicon in semiconducting applications • metal atom (Cu, Au, Pt, Pd etc.) based nanoparticles **b. Coordination complexes** Transition metal chemistry: inorganic complexes, bonding theories, magnetism, bonding aspects and structural distortion **(Organic): a. M.O. theory and π-conjugated compounds** Molecular orbitals of common functional groups, Qualitative Huckel MOs of conjugated polyenes and benzene. Aromaticity. Configuration, molecular chirality and isomerism, Conformation of alkanes and cycloalkanes **b. Polymers** Types and classification of polymers • polymerization techniques • Structure-property relationships of polymers • Conducting polymers **Physical Chemistry:** **a. Quantum chemistry** Schrodinger equation, Origin of quantization, Born interpretation of wave function, Hydrogen atom: solution to ϕ-part, Atomic orbitals, many electron atoms and spin orbitals. Chemical bonding: MO theory: LCAO molecular orbitals, Structure, bonding and energy levels of diatomic molecules. Concept of sp, sp^2 and sp^3 hybridization; Bonding and shape of many atom

		molecules; Intermolecular Forces; Potential energy Surfaces-Rates of reactions; Steady state approximation and its applications; Concept of pre-equilibrium; Equilibrium and related thermodynamic quantities **b. Electrochemistry** Electrochemical cells and Galvanic cells • EMF of a cell • Single electrode potential • Nernst equation • Electrochemical series • Types of electrodes • Reference electrodes • Batteries • Modern batteries • Fuel cells • corrosion
viii	**Texts/References**	1. J. D. Lee, "Concise Inorganic chemistry" 5th Edition. Wiley India. Ed. 2. J. E. Huheey, E. A. Keiter, R. L. Keiter, O. K. Medhi, "Inorganic Chemistry: Principles of structure and reactivity" 4th Edition, Person. 3. P. Atkins, J. de Paula, "physical chemistry" 5th Edition, Oxford. 4. J. Clayden, N. Greeves, S. Warren, "Organic chemistry" 2th Edition, Oxford. 5. George Odian, Principles of polymerization, 4th edition, Wiley student edition, Wiley India Pvt Ltd. 6. F. W. Billmeyer, Text book of Polymer Science, 3rd edition, Wiley student edition, Wiley India Pvt Ltd. 7. A. K. De, Environmental Chemistry, 8th edition, New Age International publishers. 8. B. K. Sharma, Environmental Chemistry, 16th edition, Krishna Prakashan Media Pvt Ltd. 9. A. R. West, Solid State Chemistry and Its Applications, Wiley student edition, Wiley India Pvt Ltd. 10. T. Pradeep, Nano: The essentials, McGraw-Hill Education publishers. 11. Geoffrey A Ozin and André Arsenault, Nanochemistry: A Chemical Approach to Nanomaterials, 2nd edition, RSC publishing.
ix	**Name(s) of Instructor(s)**	BLT, MRR
x	**Name(s) of other Departments/ Academic Units to whom the course is relevant**	NA
xi	**Is/Are there any course(s) in the same/ other academic unit(s) which is/ are equivalent to this course? If so, please give details.**	No
xii	**Justification/ Need for introducing the course**	This is an existing fundamental chemistry course in the institute which is now revamped by introducing pertaining engineering applications

Name of Academic Unit: Physics
Level: UG
Programme: B.Tech.

i	**Title of the Course**	PH 101: Quantum Physics and Applications
ii	**Credit Structure (L-T-P-C)**	(2-1-0-6)
iii	**Type of Course**	Core course
iv	**Semester in which normally to be offered**	Autumn
v	**Whether Full or Half Semester Course**	Full
vi	**Pre-requisite(s), if any (For the students) – *specify course number(s)***	--
vii	**Course Content**	• Quantum nature of light: Photoelectric Effect and Compton Effect. • Stability of atoms and Bohr`s rules. • Wave particle duality: De Broglie wavelength, Group and Phase velocity, Uncertainty Principle, Double Slit Experiment. • Schrödinger Equation. • Physical interpretation of Wave Function, Elementary Idea of Operators, Eigen-value Problem. • Solution of Schrödinger equation for simple boundary value problems. • Reflection and Transmission Coefficients. Tunneling. • Particle in a three dimensional box, Degenerate states. • Exposure to Harmonic Oscillator and Hydrogen Atom without deriving the general solution. • Quantum Statistics: Maxwell Boltzmann, Bose Einstein and Fermi Dirac Statistics by detailed balance arguments. • Density of states. • Applications of B-E statistics: Lasers. Bose-Einstein Condensation. • Applications of F-D statistics: Free electron model of electrons in metals. Concept of Fermi Energy. • Elementary Ideas of Band Theory of Solids. • Exposure to Semiconductors, Superconductors, Quantum Communication and Quantum Computing.
viii	**Texts/References (separate sheet may be used, if necessary)**	1. Quantum Physics: R. Eisberg and R. Resnick, John Wiley 2002, 2nd Edition. 2. Introduction to Modern Physics: F. K. Richtmyer, E. H. Kennard and J.N. Cooper, Tata Mac Graw Hill 1976, 6th Edition. 3. Modern Physics: K. S. Krane, John Wiley 1998, 2nd Edition. 4. Introduction to Modern Physics: Mani and Mehta, East-West Press Pvt. Ltd. New Delhi 2000.

		5. Elements of Modern Physics: S. H. Patil, Tata McGraw Hill, 1984. 6. Concepts of Modern Physics, A Beiser, Tata McGraw Hill, 2009.
ix	**Name(s) of Instructor(s)**	RP
x	**Name(s) of other Departments/ Academic Units to whom the course is relevant**	NA
xi	**Is/Are there any course(s) in the same/ other academic unit(s) which is/ are equivalent to this course? If so, please give details.**	No
xii	**Justification/ Need for introducing the course**	This course develops the concepts of Quantum Mechanics such that the behavior of the physical universe can be understood from a fundamental point of view. It provides a basis for further study of quantum mechanics. It is necessary for students to undertake this course, as the course sheds light on topics like, the basic principles behind the working of semiconductor devices, superconductors, etc. It is important to note that, such devices occupy the central stage in current technological advancements. The course also deals with the basic concepts behind the most advanced techniques like quantum communication and quantum computation.

i	**Title of the course**	Introduction to Programming-1
ii	**Credit Structure (L-T-P-C)**	(3-0-2-4)
iii	**Type of Course**	Core course
iv	**Semester in which normally to be offered**	Spring
v	**Whether Full or Half Semester Course**	HALF
vi	**Pre-requisite(s), if any (For the students) – *specify course number(s)***	Nil
vii	**Course Content**	This course provides an introduction to problem solving with computers using C Topics covered will include: **Utilization**: Developer fundamentals such as editor, integrated programming environment, Unix shell, modules, libraries. **Programming features**: Machine representation, data types, arrays and records, objects, expressions, control statements, iteration, procedures, functions and recursion, Pointers, Structures and basic I/O. **Applications**: Sample problems in engineering, science, text processing, and numerical methods.
viii	**Texts/References**	**The C Programming Language** Brian W Kernighan, Dennis M Ritchie, Prentice Hall India, 2nd edition, 1988 **Programming with C (Second Edition)** Byron Gottfried, Schaum's Outlines Series, Tata-Mcgraw Hill, 2011 How to Solve It by Computer, by G. Dromey, Prentice- Hall, Inc., Upper Saddle River, NJ, 1982. How to Solve _It (2nd ed.), by Polya, G., Doubleday and co, 1957. Let Us C, by Yashwant Kanetkar, Allied Publishers, 1998.
ix	**Name(s) of Instructor(s)**	
x	**Name(s) of other Departments/ Academic Units to whom the course is relevant**	All the depts in the institute
xi	**Is/Are there any course(s) in the same/ other academic unit(s) which is/ are equivalent to this course? If so, please give details.**	No
xii	**Justification/ Need for introducing the course**	Basic course in problem solving using computers.

i	Title of the course	Introduction to Programming-2
ii	Credit Structure (L-T-P-C)	(3-0-2-4)
iii	Type of Course	Core course
iv	Semester in which normally to be offered	Spring
v	Whether Full or Half Semester Course	HALF
vi	Pre-requisite(s), if any (For the students) – specify course number(s)	Nil
vii	Course Content	This is a continuation of the CS101 (first half semester) course. In the first half semester, the students are introduced to basic programming. This course (second half semester) provides an introduction to problem solving with computers using python language. Topics covered will include: Basic python programming: variables, expression and statements, Functions, conditional and recursions, iterations, strings, lists/NumPy and dictionaries. Other topics: Introduction to object oriented programming, classes and objects in python, polymorphisms, introduction to different libraries in python. Applications: Sample problems in engineering, data pre-processing, and plotting tools.
viii	Texts/References	1.Python Programming: An Introduction to Computer Science, 3rd edition by John M. Zelle, Franklin, Beedle and Associates. 2.Think Python: How to Think Like a Computer Scientist, 2nd edition, by Allen B. Downey, O'Reilly, 2015.
ix	Name(s) of Instructor(s)	
x	Name(s) of other Departments/ Academic Units to whom the course is relevant	Electrical Engineering, Mechanical Engineering
xi	Is/Are there any course(s) in the same/ other academic unit(s) which is/ are equivalent to this course? If so, please give details.	No
xii	Justification/ Need for introducing the course	Basic course in python programming.

Name of Academic Unit: Biosciences and Bioengineering
Level: B. Tech.
Programme: B.Tech.

i	**Title of the course**	BB103: Introduction to Modern Biology
ii	**Credit Structure (L-T-P-C)**	(3-0-0-6)
iii	**Type of Course**	Core course
iv	**Semester in which normally to be offered**	Autumn
v	**Whether Full or Half Semester Course**	Full
vi	**Pre-requisite(s), if any (For the students) – *specify course number(s)***	Nil
vii	**Course Content**	Quantitative views of modern biology. Importance of illustrations and building quantitative/qualitative models. Role of estimates. Cell size and shape. Temporal scales. Relative time in Biology. Key model systems – a glimpse. Management and transformation of energy in cells. Mathematical view – binding, gene expression and osmotic pressure as examples. Metabolism. Cell communication. Genetics. Eukaryotic genomes. Genetic basis of development. Evolution and diversity. Systems biology and illustrative examples of applications of Engineering in Biology.
Viii	**Texts/References**	1. Miko, I. & Lejeune, L., eds. Essentials of Genetics. Cambridge, MA: NPG Education, 2009.O'Connor, C. M. & Adams, J. U. Essentials of Cell Biology. Cambridge, MA: NPG Education,2010. 2. Watson JD, Baker, TA, Bell SP, Gann A, Levin M, Losick R, Molecular Biology of the Gene, Pearson Education, 2004. 3. Dan E. Krane, Michael L. Raymer. Fundamental Concepts of Bioinformatics, Pearson Education India. 2003
ix	**Name(s) of Instructor(s)**	SS
x	**Name(s) of other Departments/ Academic Units to whom the course is relevant**	Nil
xi	**Is/Are there any course(s) in the same/ other academic unit(s) which is/ are equivalent to this course? If so, please give details.**	No
xii	**Justification/ Need for introducing the course**	To introduce students to modem biology with an emphasis on evolution of biology as a multi-disciplinary field, to make

		them aware of application of engineering principles in biology, and engineering robust solutions inspired by biological examples. Based on student's feedback, lab experiments are being added to the course.

Name of Academic Unit: Mathematics

Level: Tick mark (or underline) only **one** of the these: ☐ UG ☐ ~~Masters~~ ☐ ~~PhD~~

1	**Title of the course**	Calculus I
2	**Credit Structure (L-T-P-C)**	L: 3 T: 1 P: 0 C: 4
3	**Mention academic programme(s) for which this course will be a core course** (Write "elective" if not core for any)	Core course
4	**Semester in which normally it is offered** Tick mark (or underline) appropriate option(s)	□ Autumn (August-Nov) □ Spring (Jan-Apr) □ Summer (May-July)
5	**Whether full or half semester course** Tick mark (or underline) appropriate option	☐ Full Semester ☐ Half Semester
6	**Course content**	Review of limits, continuity, differentiability. Mean value theorem, Taylor's Theorem, Maxima and Minima. Riemann integrals, Fundamental theorem of Calculus, Improper integrals, applications to area, volume. Convergence of sequences and series, power series.
7	**Texts/References**	1. B. V. Limaye and S. Ghorpade, A Course in Calculus and Real Analysis, Springer International Publishing (2004) 2. James Stewart, Calculus (5th Edition), Thomson Brooks/Cole (2003) 3. T. M. Apostol, Calculus, Volume 1, Wiley Eastern (1980)
8	**Name (s) of the instructor (s)**	Amlan Barua/Sagnik Sen/Shreedevi K. Masuti/Dhriti Ranjan Dolai
9	**Name (s) of other departments / Academic Units to whom the course is relevant**	

10	**Is/Are there any course(s) in the same/ other academic unit(s) which is/ are equivalent to this course? If so, please give details.**	NIL
11	**Mandatory Pre-requisite(s) - specify course number(s)**	Nil
12	**Recommended Pre-requisite(s) - specify course number(s)**	Nil
13	**Mention 8 to 12 keywords/phrases about this course that would facilitate automated course recommendation and course interdependency** (These may or may not be from the syllabus content)	Sequences, Series, Limits, Continuity, Differentiability, Riemann Integration
14	**Justification/ Need for introducing the course**	This course focuses on the rigorous introduction to the subject of single variable calculus. It is a foundational mathematics course that introduces key concepts like sequence and series, definition of limits, continuity and differentiability. The course serves as a background for many subsequent courses offered in the under graduate curriculum.

Name of Academic Unit: Mathematics

Level: Tick mark (or underline) only **one** of the these: ☐ UG ☐ ~~Masters~~ ☐ ~~PhD~~

1	**Title of the course**	Calculus II
2	**Credit Structure (L-T-P-C)**	L: 3 T: 1 P: 0 C: 4
3	**Mention academic programme(s) for which this course will be a core course** (Write "elective" if not core for any)	Core course
4	**Semester in which normally it is offered** Tick mark (or underline) appropriate option(s)	□ Autumn (August-Nov) □ Spring (Jan-Apr) □ Summer (May-July)
5	**Whether full or half semester course** Tick mark (or underline) appropriate option	☐ Full Semester ☐ Half Semester
6	**Course content**	Partial Derivatives, gradient and directional derivatives, Chain rule, Maxima and Minima, Lagrange multipliers. Double and Triple integration, Jacobians and change of variables formula. Parametrization of Curves and Surfaces, Vector fields, Line and Surface integrals. Divergence and Curl, Theorems of Green, Gauss, and Stokes.
7	**Texts/References**	1. B.V. Limaye and S. Ghorpade, A Course in Multivariable Calculus and Real Analysis, Springer International Publishing (2010) 2. James Stewart, Calculus (5th Edition), Thomson Brooks/Cole (2003) 3. T. M. Apostol, Calculus, Volume 2, Wiley Eastern (1980) 4. Marsden and Tromba, Vector calculus (First Indian Edition), Springer (2012)
8	**Name (s) of the instructor (s)**	Amlan Barua/Sagnik Sen/Shreedevi K. Masuti/Dhriti Ranjan Dolai
9	**Name (s) of other departments / Academic Units to whom the course is relevant**	

10	**Is/Are there any course(s) in the same/ other academic unit(s) which is/ are equivalent to this course? If so, please give details.**	NIL
11	**Mandatory Pre-requisite(s) - specify course number(s)**	Calculus I or Instructor's consent
12	**Recommended Pre-requisite(s) - specify course number(s)**	Nil
13	**Mention 8 to 12 keywords/phrases about this course that would facilitate automated course recommendation and course interdependency** (These may or may not be from the syllabus content)	Partial derivatives, Total derivative, Lagrange multipliers, Multivariate integration and Gauss, Green and Stokes theorem.
14	**Justification/ Need for introducing the course**	This is a first course on multi-variable calculus which introduces the concept of partial derivatives, total derivative, multivariate integration and Gauss, Green and Stokes theorem. The course is essential for different branches of under-graduate program since the multi-variable calculus finds it use in application domain (fluid mechanics, electro-magnetism etc.) as well theoretical studies (partial differential equations, theoretical physics etc.)

Introduction to Fine Arts

Theatre Segment

Instructor: Dr Prakash Garud

1. Introduction to theatre
    a. Concept of Play and Performance
    b. Folk: Both from Classical and Contemporary perspective
2. Explicating the styles of performance (stylization covers Realistic, Surrealistic, modern and postmodern aspects)
3. Engaging with text (Play) focusing speech and movement
4. Practicing spot improvisation
5. Play script
6. Skit improvisation and practice.
7. Demo by the participants

Music Segment

Instructor: Raghavendra Kammar

1. To give an understanding of what music is and what it means to us.
2. Explain the concept of pitch, sound, tone etc.
3. Explain the meaning of Navarasas and the process of finding them with musical notes.
4. Explanation of Shruti and Laya and its significance.
5. Briefly exploring the science in music.
6. Exploring the ability of a student in expressing a story with music.
7. Practice and Demonstration by students with description of pitch, sound, tone, voice, music.

Puppetry Segment

Instructor: Ms. Rajani Garud

1. Exploring the history and theories of Puppetry
2. Exploring different forms of puppetry.
3. Give practice to students in multiple performance expressions
4. Provide the students with experience with a variety of tools and materials involved in puppetry art.
5. Students are guided to take movement classes, fabric manipulation classes, design classes, drawing classes, rendering classes and stop motion classes.

Dance Segment

Instructor: Ms. Meghana Chandramouly

1. Introduction to the Dance
    a. Concept of Dance and the concept of Performance
    b. Different forms of dance
2. Dance segment will explore the Indian Contemporary/Freestyle dance practices
3. Focus is given on the comprehensive improvisation of movement of a choreographer/dancer.
4. Observing the capability of dancers, improvisation of movement will be choreographed.

Name of Academic Unit: HSS
Level: B.Tech.
Programme: B.Tech.

i	**Title of the course**	HS 106 Design thinking and Creativity
ii	**Credit Structure (L-T-P-C)**	1-0-0-0
iii	**Type of Course**	Core course / Institute level
iv	**Semester in which normally to be offered**	Autumn
v	**Whether Full or Half Semester Course**	Full Semester
vi	**Pre-requisite(s), if any (For the students) – specify course number(s)**	Nil
vii	**Course Content**	1.Problem Exploration- Students move around and find problems that need solutions. 2.They analyse the problem (not solution) and evolve a problem space. The problem space is converted into a story boar and presented in a poster session. 3.Feedback at the poster session is used to refine the problem definition(s). 4.Solution Exploration: Creative solutions (solution space) are now explored and presented using story boards. 5.The solutions are converted into "embodiments"
viii	**Texts/References**	1."Stuff Matters" Prof. Mark Miodownik, Penguin 2. "Design and Technology" by James Garratt, Cambridge University Press. 3.How it works in the home: Walt Disney :9780894340482- Amazon.com. 4.How it works in the City (Walt Disney available on Amazon.com) 5.Change by design – Tim Brown There are some additional books in this "How it Works" series.
ix	**Name(s) of Instructor(s)**	Abhi Paul and C. Amarnath
x	**Name(s) of other Departments/ Academic Units to whom the course is relevant**	All Depts. Across the Institute
xi	**Is/Are there any course(s) in the same/ other academic unit(s) which is/ are equivalent to this course? If so, please give details.**	No
xii	**Justification/ Need for introducing the course**	This is a basic course essential for all branches of engineering to train students in identifying and comprehending problems- followed by ideation for seeking "technology" solutions.