



Royal School of Information Technology (RSIT)

Course Structure & Syllabus

(Based on National Education Policy 2020)

For

Bachelor of Information Technology (BSc. IT)

W.E.F

AY: 2023-2024

TABLE OF CONTENTS

Section	Header	Page no.
	<i>Preamble</i>	3
1	Overview	4
2	Award of Degree	13
3	Credit, Credit Points & Credit hours for different types of courses	16
4	Level	20
5	Graduate Attributes & Learning Outcomes	22
6	Course Structure and Syllabus of the Framework	27

Preamble

The National Education Policy (NEP) 2020 conceives a new vision for India's higher education system. It recognizes that higher education plays an extremely important role in promoting equity, human as well as societal well-being and in developing India as envisioned in its Constitution. It is desired that higher education will significantly contribute towards sustainable livelihoods and economic development of the nation as India moves towards becoming a knowledge economy and society.

Towards the attainment of holistic and multidisciplinary education, the flexible curricula of the University will include credit-based courses, projects in the areas of community engagement and service, environmental education, and value-based education. As part of holistic education, students will also be provided with opportunities for internships with local industries, businesses, artists, crafts persons, and so on, as well as research internships with faculty and researchers at the University, so that students may actively engage with the practical aspects of their learning and thereby improve their employability.

At The Assam RGU, we are committed that at the societal level, higher education will enable each student to develop themselves to be an enlightened, socially conscious, knowledgeable, and skilled citizen who can find and implement robust solutions to its own problems. For the students at the University, Higher education is expected to form the basis for knowledge creation and innovation thereby contributing to a more vibrant, socially engaged, cooperative community leading towards a happier, cohesive, cultured, productive, innovative, progressive, and prosperous nation.”

The Bachelor of Science in Information Technology (BSc. IT) program, designed in alignment with the National Education Policy (NEP) 2020, aims to provide a comprehensive curriculum that emphasizes the development of both theoretical knowledge and practical skills in the field of information technology. The program is structured to foster critical thinking, problem-solving capabilities, and an entrepreneurial mindset among students. Embracing the holistic and multidisciplinary approach of NEP 2020, the BSc. IT curriculum integrates core IT courses with interdisciplinary studies and soft skills training, ensuring students are well-prepared to adapt and innovate in the rapidly evolving digital landscape. Additionally, the program offers flexibility in course choices and durations, encouraging students to pursue internships and projects that align with their career goals and interests, ultimately molding them into skilled professionals

1. 1. Introduction:

1.1.1 About NEP 2020

The National Education Policy (NEP) 2020 clearly indicates that higher education plays an extremely important role in promoting human as well as societal well-being in India. As envisioned in the 21st-century requirements, quality higher education must aim to develop good, thoughtful, well-rounded, and creative individuals. According to the new education policy, assessments of educational approaches in undergraduate education will integrate the humanities and arts with Science, Technology, Engineering and Mathematics (STEM) that will lead to positive learning outcomes. This will lead to develop creativity and innovation, critical thinking and higher-order thinking capacities, problem-solving abilities, teamwork, communication skills, more in-depth learning, and mastery of curricula across fields, increases in social and moral awareness, etc., besides general engagement and enjoyment of learning. and more in-depth learning.

The NEP highlights that the following fundamental principles that have a direct bearing on the curricula would guide the education system at large, viz.

- i. Recognizing, identifying, and fostering the unique capabilities of each student to promote her/his holistic development.
- ii. Flexibility, so that learners can select their learning trajectories and programmes, and thereby choose their own paths in life according to their talents and interests.
- iii. Emphasis on conceptual understanding rather than rote learning, critical thinking to encourage logical decision-making and innovation; ethics and human & constitutional values, and life skills such as communication, teamwork, leadership, and resilience.
- iv. Extensive use of technology in teaching and learning, removing language barriers, increasing access for Divyang students, and educational planning and management.
- v. Respect for diversity and respect for the local context in all curricula, pedagogy, and policy.

- vi. Equity and inclusion as the cornerstone of all educational decisions to ensure that all students can thrive in the education system and the institutional environment are responsive to differences to ensure that high-quality education is available for all.

1.1.2 About the BSc. IT Course:

The Bachelor of Science in Information Technology (BSc. IT) program, structured according to the National Education Policy (NEP) 2020, aims to equip students with a deep understanding of information technology alongside a broad interdisciplinary educational foundation. This updated curriculum is designed to enhance analytical thinking, algorithmic skills, and software development capabilities while integrating insights from data science, artificial intelligence, and cybersecurity. Embracing the NEP's flexible and student-centric approach, the BSc. IT program allows learners to choose from a wide array of elective subjects, which not only expands their technical prowess but also hones their entrepreneurial and innovative thinking skills .

Furthermore, the BSc. IT program under NEP 2020 emphasizes the development of key soft skills such as communication, teamwork, and problem-solving, which are vital in today's collaborative and dynamic work environments. The inclusion of mandatory internship opportunities and project work in the curriculum ensures that students can apply their theoretical knowledge in real-world settings, bridging the gap between academic learning and professional requirements. This hands-on experience is critical in preparing graduates for the technological challenges of the future, making them valuable assets in a global and highly competitive job market.

1.1.3 Vision

To cultivate globally competent information technology professionals through integrated educational experiences and diverse cultural exposure, preparing graduates to excel in a dynamic international environment.

1.1.4 Mission

- To foster academic excellence in the field of information technology through cutting-edge, research-driven, and industry-relevant education
- To instil ethical conduct and compassion through active community engagement.
- To develop responsible leaders who are poised to drive positive change and shape the future of technology and society.

1.2. Credits in Indian Context:

1.2.1. Choice Based Credit System (CBCS)

Under the CBCS system, the requirement for awarding a degree or diploma or certificate is prescribed in terms of the number of credits to be earned by the students. This framework is being implemented in several universities across States in India. The main highlights of CBCS are as below:

- The CBCS provides flexibility in designing curriculum and assigning credits based on the course content and learning hours.
- The CBCS provides for a system wherein students can take courses of their choice, learn at their own pace, undergo additional courses and acquire more than the required credits, and adopt an interdisciplinary approach to learning.
- CBCS also provides opportunity for vertical mobility to students from a bachelor's degree programme to masters and research degree programmes.

1.3. Definitions

1.3.1. Academic Credit:

An academic credit is a unit by which a course is weighted. It is fixed by the number of hours of instructions offered per week. As per the National Credit Framework:

1 Credit = 30 NOTIONAL CREDIT HOURS (NCH)

Yearly Learning Hours = 1200 Notional Hours (@40 Credits x 30 NCH)

30 Notional Credit Hours		
Lecture/Tutorial	Practicum	Experiential Learning
1 Credit = 15 -22 Lecture Hours	10-15 Practicum Hours	0-8 Experiential Learning Hours

1 Hr. Lecture (L) per week	1 credit
1 Hr. Tutorial (T) per week	1 credit
1 Hr. Practical (P) per week	0.5 credits
2 Hours Practical (Lab) per week	1 credit

1.3.2. Course of Study:

Course of study indicates pursuance of study in a particular discipline/programme. Discipline/Programmes shall offer Major Courses (Core), Minor Courses, Skill Enhancement Courses (SEC), Value Added Courses (VAC), Ability Enhancement Compulsory Courses (AECCs) and Interdisciplinary courses.

1.3.3. Disciplinary Major:

The major would provide the opportunity for a student to pursue in-depth study of a particular subject or discipline. Students may be allowed to change major within the broad discipline at the end of the second semester by giving her/him sufficient time to explore interdisciplinary courses during the first year. Advanced-level disciplinary/interdisciplinary courses, a course in research methodology, and a project/dissertation will be conducted in the seventh semester. The final semester will be devoted to seminar presentation, preparation, and submission of project report/dissertation. The project work/dissertation will be on a topic in the disciplinary programme of study or an interdisciplinary topic.

1.3.4. Disciplinary/interdisciplinary minors:

Students will have the option to choose courses from disciplinary/interdisciplinary minors and skill-based courses. Students who take a sufficient number of courses in a discipline or an interdisciplinary area of study other than the chosen major will qualify for a minor in that discipline or in the chosen interdisciplinary area of study. A student may declare the choice of the minor at the end of the second semester, after exploring various courses.

1.3.5. Courses from Other Disciplines (Interdisciplinary):

All UG students are required to undergo 3 introductory-level courses relating to any of the broad disciplines given below. These courses are intended to broaden the intellectual experience and form part of liberal arts and science education. Students are not allowed to choose or repeat courses already undergone at the higher secondary level (12th class) in the proposed major and minor stream under this category.

i. Natural and Physical Sciences: Students can choose basic courses from disciplines such as Natural Science, for example, Biology, Botany, Zoology, Biotechnology, Biochemistry, Chemistry, Physics, Biophysics, Astronomy and Astrophysics, Earth and Environmental Sciences, etc.

ii. Mathematics, Statistics, and Computer Applications: Courses under this category will facilitate the students to use and apply tools and techniques in their

major and minor disciplines. The course may include training in programming software like Python among others and applications software like STATA, SPSS, Tally, etc. Basic courses under this category will be helpful for science and social science in data analysis and the application of quantitative tools.

iii. Library, Information, and Media Sciences: Courses from this category will help the students to understand the recent developments in information and media science (journalism, mass media, and communication)

iv. Commerce and Management: Courses include business management, accountancy, finance, financial institutions, fintech, etc.,

v. Humanities and Social Sciences: The courses relating to Social Sciences, for example, Anthropology, Communication and Media, Economics, History, Linguistics, Political Science, Psychology, Social Work, Sociology, etc. will enable students to understand the individuals and their social behaviour, society, and nation. Students be introduced to survey methodology and available large-scale databases for India. The courses under humanities include, for example, Archaeology, History, Comparative Literature, Arts & Creative expressions, Creative Writing and Literature, language(s), Philosophy, etc., and interdisciplinary courses relating to humanities. The list of Courses can include interdisciplinary subjects such as Cognitive Science, Environmental Science, Gender Studies, Global Environment & Health, International Relations, Political Economy and Development, Sustainable Development, Women's, and Gender Studies, etc. will be useful to understand society .

1.3.6. Ability Enhancement Courses (AEC):

Modern Indian Language (MIL) & English language focused on language and communication skills. Students are required to achieve competency in a Modern Indian Language (MIL) and in the English language with special emphasis on language and communication skills. The courses aim at enabling the students to acquire and demonstrate the core linguistic skills, including critical reading and expository and academic writing skills, that help students articulate their arguments and present their thinking clearly and coherently and recognize the importance of language as a mediator of knowledge and identity. They would also enable students to acquaint themselves with the cultural and intellectual heritage of the chosen MIL

and English language, as well as to provide a reflective understanding of the structure and complexity of the language/literature related to both the MIL and English language. The courses will also emphasize the development and enhancement of skills such as communication, and the ability to participate/conduct discussion and debate.

1.3.7. Skill Enhancement Course (SEC):

These courses are aimed at imparting practical skills, hands-on training, soft skills, etc., to enhance the employability of students and should be related to Major Discipline. They will aim at providing hands-on training, competencies, proficiency, and skill to students. SEC course will be a basket course to provide skill-based instruction. For example, SEC of English Discipline may include Public Speaking, Translation & Editing and Content writing. A student shall have the choice to choose from a list, a defined track of courses offered from 1st to 3rd semester.

1.3.8. Value-Added Courses (VAC):

i. Understanding India: The course aims at enabling the students to acquire and demonstrate the knowledge and understanding of contemporary India with its historical perspective, the basic framework of the goals and policies of national development, and the constitutional obligations with special emphasis on constitutional values and fundamental rights and duties. The course would also focus on developing an understanding among student-teachers of the Indian knowledge systems, the Indian education system, and the roles and obligations of teachers to the nation in general and to the school/community/society. The course will attempt to deepen knowledge about and understanding of India's freedom struggle and of the values and ideals that it represented to develop an appreciation of the contributions made by people of all sections and regions of the

country, and help learners understand and cherish the values enshrined in the Indian Constitution and to prepare them for their roles and responsibilities as effective citizens of a democratic society.

ii. Environmental science/education: The course seeks to equip students with the ability to apply the acquired knowledge, skills, attitudes, and values required to take appropriate actions for mitigating the effects of environmental degradation, climate change, and pollution, effective waste management, conservation of biological diversity, management of biological resources, forest and wildlife conservation, and sustainable development and living. The course will also deepen the knowledge and understanding of India's environment in its totality, its interactive processes, and its effects on the future quality of people's lives.

iii. Digital and technological solutions: Courses in cutting-edge areas that are fast gaining prominences, such as Artificial Intelligence (AI), 3-D machining, big data analysis, machine learning, drone technologies, and Deep learning with important applications to health, environment, and sustainable living that will be woven into undergraduate education for enhancing the employability of the youth.

iv. Health & Wellness, Yoga education, sports, and fitness: Course components relating to health and wellness seek to promote an optimal state of physical, emotional, intellectual, social, spiritual, and environmental well-being of a person. Sports and fitness activities will be organized outside the regular institutional working hours. Yoga education would focus on preparing the students physically and mentally for the integration of their physical, mental, and spiritual faculties, and equipping them with basic knowledge about one's personality, maintaining self-discipline and self-control, to learn to handle oneself well in all life situations. The focus of sports and fitness components of the courses will be on the improvement of physical fitness including the improvement of various components of physical and skills-related fitness like strength, speed, coordination, endurance, and flexibility; acquisition of sports skills including motor skills as well as basic movement skills relevant to a particular sport; improvement of tactical abilities; and improvement of mental abilities.

These are a common pool of courses offered by different disciplines and aimed towards embedding ethical, cultural and constitutional values; promote critical thinking. Indian knowledge systems; scientific temperament of students.

1.3.9. Summer Internship /Apprenticeship:

The intention is induction into actual work situations. All students must undergo internships / Apprenticeships in a firm, industry, or organization or Training in labs with faculty and researchers in their own or other HEIs/research institutions during the **summer term**. Students should take up opportunities for internships with local industry, business organizations, health and allied areas, local governments (such as panchayats, municipalities), Parliament or elected representatives, media organizations, artists, crafts persons, and a wide variety of organizations so that students may actively engage with the practical side of their learning and, as a by-product, further improve their employability. Students who wish to exit after the first two semesters will undergo a 4-credit work-based learning/internship during the summer term to get a UG Certificate.

1.3.9.1. Community engagement and service: The curricular component of 'community engagement and service' seeks to expose students to the socio-economic issues in society so that the theoretical learnings can be supplemented by actual life experiences to generate solutions to real-life problems. This can be part of summer term activity or part of a major or minor course depending upon the major discipline.

1.3.9.2. Field-based learning/minor project: The field-based learning/minor project will attempt to provide opportunities for students to understand the different socio-economic contexts. It will aim at giving students exposure to development-related issues in rural and urban settings. It will provide opportunities for students to observe situations in rural and urban contexts, and to observe and study actual field situations regarding issues related to socioeconomic development. Students will be given opportunities to gain a first-hand understanding of the policies, regulations, organizational structures, processes, and programmes that guide the development process. They would have the opportunity to gain an understanding of the complex socio-economic problems in the community, and innovative practices required to generate

solutions to the identified problems. This may be a summer term project or part of a major or minor course depending on the subject of study.

1.3.10. Indian Knowledge System:

In view of the importance accorded in the NEP 2020 to rooting our curricula and pedagogy in the Indian context all the students who are enrolled in the four-year UG programmes should be encouraged to take an adequate number of courses in IKS so that the ***total credits of the courses taken in IKS amount to at least five per cent of the total mandated credits (i.e. min. 8 credits for a 4 yr. UGP & 6 credits for a 3 yr. UGP)***. The students may be encouraged to take these courses, preferably *during the first four semesters of the UG programme*. At least half of these mandated credits should be in courses in disciplines which are part of IKS and are related to the major field of specialization that the student is pursuing in the UG programme. They will be included as a part of the total mandated credits that the student is expected to take in the major field of specialization. The rest of the mandated credits in IKS can be included as a part of the mandated Multidisciplinary courses that are to be taken by every student. All the students should take a Foundational Course in Indian Knowledge System, which is designed to present an overall introduction to all the streams of IKS relevant to the UG programme. The foundational IKS course should be broad-based and cover introductory material on all aspects.

Wherever possible, the students may be encouraged to choose a suitable topic related to IKS for their project work in the 7/8th semesters of the UG programme.

(Note: Refer “Guidelines for Incorporating Indian Knowledge in Higher Education Curricula”, University Grants Commission, March 2023 for further details)

1.3.11. Experiential Learning:

One of the most unique, practical & beneficial features of the National Credit Framework is assignment of credits/credit points/ weightage to the experiential learning including relevant experience and professional levels acquired/ proficiency/ professional levels of a learner/student. Experiential learning is of two types:

a. Experiential learning as part of the curricular structure of academic or vocational program. E.g., projects/OJT/internship/industrial attachments etc. This could be either within the Program- internship/ summer project undertaken relevant to the program being studied or as a part time employment (not relevant to the program being studied- up to certain NSQF level only). In case where

experiential learning is a part of the curricular structure the credits would be calculated and assigned as per basic principles of NCrf i.e., 40 credits for 1200 hours of notional learning.

b. Experiential learning as active employment (both wage and self) post completion of an academic or vocational program. This means that the experience attained by a person after undergoing a particular educational program shall be considered for assignment of credits. This could be either Full or Part time employment after undertaking an academic/ Vocation program.

In case where experiential learning is as a part of employment the learner would earn credits as weightage. The maximum credit points earned in this case shall be double of the credit points earned with respect to the qualification/ course completed. The credit earned and assigned by virtue of relevant experience would enable learners to progress in their career through the work hours put in during a job/employment.

Section 2

Award of Degree

The structure and duration of undergraduate programmes of study offered by the University as per NEP 2020 include:

- 2.1.1. Undergraduate programmes** of either 3 or 4-year duration with Single Major, with multiple entry and exit options, with appropriate certifications:
- 2.1.2. UG Certificate:** Students who opt to exit after completion of the first year and have secured 40 credits will be awarded a UG certificate if, in addition, they complete one vocational course of 4 credits during the summer vacation of the first year. These students are allowed to re-enter the degree programme within three years and complete the degree programme within the stipulated maximum period of seven years.
- 2.1.3. UG Diploma:** Students who opt to exit after completion of the second year and have secured 80 credits will be awarded the UG diploma if, in addition, they complete one vocational course of 4 credits during the summer vacation of the second year. These students are allowed to re-enter within a period of three years and complete the degree programme within the maximum period of seven years.
- 2.1.4. 3-year UG Degree:** Students who will undergo a 3-year UG programme will be awarded UG Degree in the Major discipline after successful completion of three years, securing 120 credits and satisfying the minimum credit requirement.
- 2.1.5. 4-year UG Degree (Honours):** A four-year UG Honours degree in the major discipline will be awarded to those who complete a four-year degree programme with 160 credits and have satisfied the credit requirements as given in Table 6 in Section 5.
- 2.1.6. 4-year UG Degree (Honours with Research):** Students who secure 75% marks and above in the first six semesters and wish to undertake research at the undergraduate level can choose a research stream in the fourth year. They should do a research project or dissertation under the guidance of a Faculty Member of the University. The research project/dissertation will be in the major discipline.

The students who secure 160 credits, including 12 credits from a research project/dissertation, will be awarded UG Degree (Honours with Research).

2.1.7. (Note: *UG Degree Programmes with Single Major*: A student must secure a minimum of 50% credits from the major discipline for the 3-year/4-year UG degree to be awarded a single major. For example, in a 3-year UG programme, if the total number of credits to be earned is 120, a student of Mathematics with a minimum of 60 credits will be awarded a B.Sc. in Mathematics with a single major. Similarly, in a 4-year UG programme, if the total number of credits to be earned is 160, a student of Chemistry with a minimum of 80 credits will be awarded a B.Sc. (Hons./Hon. With Research) in Chemistry in a 4-year UG programme with single major. Also the **4-year Bachelor's degree programme with Single Major** is considered as the preferred option since it would allow the opportunity to experience the full range of holistic and multidisciplinary education in addition to a focus on the chosen major and minors as per the choices of the student.)

Table: 1: Award of Degree and Credit Structure with ME-ME

Award	Year	Credits to earn	Additional Credits	Re-entry allowed within (yrs)	Years to Complete
UG Certificate	1	40	4	3	7
UG Diploma	2	80	4	3	7
3-year UG Degree (Major)	3	120	X	x	x
4-year UG Degree (Honours)	4	160	X	x	x
4-year UG Degree (Honors with Research):	4	160	Students who secure cumulative 75% marks and above in the first sixsemesters		

Credit, Credit Points & Credit hours for different types of courses

3.1. Introduction:

'**Credit**' is recognition that a learner has completed a prior course of learning, corresponding to a qualification at a given level. For each such prior qualification, the student would have put in a certain volume of institutional or workplace learning, and the more complex a qualification, the greater the volume of learning that would have gone into it. Credits quantify learning outcomes that are subject achieving the prescribed learning outcomes to valid, reliable methods of assessment.

The **credit points** will give the learners, employers, and institutions a mechanism for describing and comparing the learning outcomes achieved. The credit points can be calculated as credits attained multiplied with the credit level.

The workload relating to a course is measured in terms of credit hours. A credit is a unit by which the coursework is measured. It determines the number of hours of instruction required per week over the duration of a semester (minimum 15 weeks). Each course may have only a lecture component or a lecture and tutorial component or a lecture and practicum component or a lecture, tutorial, and practicum component, or only practicum component.

A course can have a combination of **lecture credits, tutorial credits, practicum credits and experiential learning credits**. The following types of courses/activities constitute the programmes of study. Each of them will require a specific number of hours of teaching/guidance and laboratory/studio/workshop activities, field-based learning/projects, internships, and community engagement and service.

- **Lecture courses:** Courses involving lectures relating to a field or discipline by an expert or qualified personnel in a field of learning, work/vocation, or professional practice.
- **Tutorial courses:** Courses involving problem-solving and discussions relating to a field or discipline under the guidance of qualified personnel in a field of learning, work/vocation, or professional practice. Should also refer to the Remedial Classes, flip classrooms and focus on both Slow and Fast Learners of the class according to their merit.

- **Practicum or Laboratory work:** A course requiring students to participate in a project or practical or lab activity that applies previously learned/studied principles/theory related to the chosen field of learning, work/vocation, or professional practice under the supervision of an expert or qualified individual in the field of learning, work/vocation or professional practice.
- **Seminar:** A course requiring students to participate in structured discussion/conversation or debate focused on assigned tasks/readings, current or historical events, or shared experiences guided or led by an expert or qualified personnel in a field of learning, work/vocation, or professional practice.
- **Internship:** A course requiring students to participate in a professional activity or work experience, or cooperative education activity with an entity external to the education institution, normally under the supervision of an expert of the given external entity. A key aspect of the internship is induction into actual work situations. Internships involve working with local industry, government or private organizations, business organizations, artists, crafts persons, and similar entities to provide opportunities for students to actively engage in on-site experiential learning.
- **Field practice/projects:** Courses requiring students to participate in field-based learning/projects generally under the supervision of an expert of the given external entity.
- **Community engagement and service:** Courses requiring students to participate in field-based learning/projects generally under the supervision of an expert of the given external entity. The curricular component of 'community engagement and service' will involve activities that would expose students to the socio-economic issues in society so that the theoretical learnings can be supplemented by actual life experiences to generate solutions to real-life problems.

Table:2: Course wise Distribution of Credits

Broad Category of Course	Minimum Credit Requirement	
	3-year UG	4-Year UG
Major (Core)	60	80
Minor Stream	24	32
Interdisciplinary	9	9
Ability Enhancement Courses (AEC)	8	8
Skill Enhancement Courses (SEC)	9	9
Value Added Courses common for all UG	6	6
Summer Internship	4	4
Research Project /Dissertation	NA	12
Total	120	160

Table 3: Credit Distribution for 3-year Course

Semester	Course Credits							
	Major	Minor	ID	AEC	SEC	VAC	SI	Total
I	6	3	3	2	3	3	0	20
II	6	3	3	2	3	3	0	20
III	8	4	3	2	3	0	0	20
IV	12	6	0	2	0	0	0	20
V	12	4	0	0	0	0	4	20
VI	16	4	0	0	0	0	0	20
	60	24	9	8	9	6	4	120

Table 4: Credit Distribution for 4-year Course

Semester	Course Credits								Total
	Major	Minor	ID	AEC	SEC	VAC	SI	RP	
I	6	3	3	2	3	3	0	0	20
II	6	3	3	2	3	3	0	0	20
III	8	4	3	2	3	0	0	0	20
IV	12	6	0	2	0	0	0	0	20
V	12	4	0	0	0	0	4	0	20
VI	16	4	0	0	0	0	0	0	20
VII	16	4	0	0	0	0	0	0	20
VIII	4	4	0	0	0	0	0	12	20
	80	32	9	8	9	6	4	12	160

Level of Courses

4.1 NHEQF levels:

The NHEQF levels represent a series of sequential stages expressed in terms of a range of learning outcomes against which typical qualifications are positioned/located. NHEQF level 4.5 represents learning outcomes appropriate to the first year (first two semesters) of the undergraduate programme of study, while Level 8 represents learning outcomes appropriate to the doctoral-level programme of study.

Table: 5: NHEQF Levels

NHEQF level	Examples of higher education qualifications located within each level	Credit Requirements
Level 4.5	Undergraduate Certificate. Programme duration: First year (first two semesters) of the undergraduate programme, followed by an exit 4-credit skills-enhancement course(s).	40
Level 5	Undergraduate Diploma. Programme duration: First two years (first four semesters) of the undergraduate programme, followed by an exit 4-credit skills-enhancement course(s) lasting two months.	80
Level 5.5	Bachelor's Degree. Programme duration: First three years (Six semesters) of the four-year undergraduate programme.	120
Level 6	Bachelor's Degree (Honours/ Honours with Research). Programme duration: Four years (eight semesters).	160
Level 6	Post-Graduate Diploma. Programme duration: One year (two semesters) for those who exit after successful completion of the first year (two semesters) of the 2-year master's programme	160
Level 6.5	Master's degree. Programme duration: Two years (four semesters) after obtaining a 3- year Bachelor's degree (e.g. B.A., B.Sc., B.Com. etc.).	80
Level 6.5	Master's degree. Programme duration: One year (two semesters) after obtaining a 4 -year Bachelor's degree (Honours/ Honours with Research) (e.g. B.A., B.Sc., B.Com. etc.).	40
Level 7	Master's degree. (e.g., M.E./M.Tech. etc.) Programme duration: Two years (four semesters) after obtaining a 4-year Bachelor's degree. (e.g., B.E./B.Tech. etc.)	80
Level 8	Doctoral Degree	Credits for course work, Thesis, and published work

4.2. Course Code based on Learning Outcomes:

Courses are coded based on the learning outcomes, level of difficulty, and academic rigor. The coding structure is as follows:

i. 0-99: *Pre-requisite courses* required to undertake an introductory course which will be a pass or fail course with no credits. It will replace the existing informal way of offering bridge courses that are conducted in some of the colleges/ universities.

ii. 100-199: *Foundation or introductory courses* that are intended for students to gain an understanding and basic knowledge about the subjects and help decide the subject or discipline of interest. These courses may also be prerequisites for courses in the major subject. These courses generally would focus on foundational theories, concepts, perspectives, principles, methods, and procedures of critical thinking in order to provide a broad basis for taking up more advanced courses.

iii. 200-299: *Intermediate-level courses* including subject-specific courses intended to meet the credit requirements for minor or major areas of learning. These courses can be part of a major and can be pre-requisite courses for advanced-level major courses.

iv. 300-399: *Higher-level courses* which are required for majoring in a disciplinary/interdisciplinary area of study for the award of a degree.

v. 400-499: *Advanced courses* which would include lecture courses with practicum, seminar-based course, term papers, research methodology, advanced laboratory experiments/software training, research projects, hands-on-training, internship/apprenticeship projects at the undergraduate level or First year post-graduate theoretical and practical courses.

vi. 500-599: *Courses at first-year PG degree level* for a 2-year post-graduate degree programme

vii. 600-699: *Courses for second year of 2-year PG* or 1-year post-graduate degree programme

viii. 700 -799 & above: Courses limited to doctoral students.

Graduate Attributes & Learning Outcomes

5.1 Introduction

As per the NHEQF, each student on completion of a programme of study must possess and demonstrate the expected **Graduate Attributes** acquired through one or more modes of learning, including direct in-person or face-to-face instruction, online learning, and hybrid/blended modes. The graduate attributes indicate the quality and features or characteristics of the graduate of a programme of study, including learning outcomes relating to the disciplinary area(s) relating to the chosen field(s) of learning and generic learning outcomes that are expected to be acquired by a graduate on completion of the programme(s) of study.

The graduate profile/attributes must include,

- capabilities that help widen the current knowledge base and skills,
- gain and apply new knowledge and skills,
- undertake future studies independently, perform well in a chosen career, and
- play a constructive role as a responsible citizen in society.

The graduate profile/attributes are acquired incrementally through development of cognitive levels and describe a set of competencies that are transferable beyond the study of a particular subject/disciplinary area and programme contexts in which they have been developed.

Graduate attributes include,

- **learning outcomes that are specific to disciplinary areas** relating to the chosen field(s) of learning within broad multidisciplinary/interdisciplinary/ transdisciplinary contexts.
- **generic learning outcomes** that graduate of all programmes of study should acquire and demonstrate.

5.2 Graduate Attributes:

Table: 6: The Learning Outcomes Descriptors and Graduate Attributes

Sl.no.	Graduate Attribute	The Learning Outcomes Descriptors (The graduates should be able to demonstrate the capability to:)
GA1	Disciplinary Knowledge	acquire knowledge and coherent understanding of the chosen disciplinary/interdisciplinary areas of study.

Sl.no.	Graduate Attribute	The Learning Outcomes Descriptors <i>(The graduates should be able to demonstrate the capability to:)</i>
GA 2	Complex problem solving	solve different kinds of problems in familiar and non-familiar contexts and apply the learning to real-life situations.
GA 3	Analytical & Critical thinking	apply analytical thought including the analysis and evaluation of policies, and practices. Able to identify relevant assumptions or implications. Identify logical flaws and holes in the arguments of others. Analyse and synthesize data from a variety of sources and draw valid conclusions and support them with evidence and examples.
GA 4	Creativity	create, perform, or think in different and diverse ways about the same objects or scenarios and deal with problems and situations that do not have simple solutions. Think 'out of the box' and generate solutions to complex problems in unfamiliar contexts by adopting innovative, imaginative, lateral thinking, interpersonal skills, and emotional intelligence.
GA 5	Communication Skills	listen carefully, read texts and research papers analytically, and present complex information in a clear and concise manner to different groups/audiences. Express thoughts and ideas effectively in writing and orally and communicate with others using appropriate media.
GA 6	Research-related skills	develop a keen sense of observation, inquiry, and capability for asking relevant/ appropriate questions. Should acquire the ability to problematize, synthesize and articulate issues and design research proposals, define problems, formulate appropriate and relevant research questions, formulate hypotheses, test hypotheses using quantitative and qualitative data, establish hypotheses, make inferences based on the analysis and interpretation of data, and predict cause-and-effect relationships. Should develop the ability to acquire the understanding of basic research ethics and skills in practicing/doing ethics in the field/ in personal research work.
GA 7	Collaboration	work effectively and respectfully with diverse teams in the interests of a common cause and work efficiently as a member of a team.
GA 8	Leadership readiness/qualities	plan the tasks of a team or an organization and setting direction by formulating an inspiring vision and building a team that can help achieve the vision.
GA 9	Digital and	use ICT in a variety of learning and work

Sl.no.	Graduate Attribute	The Learning Outcomes Descriptors (The graduates should be able to demonstrate the capability to:)
	technological skills	situations. Access, evaluate, and use a variety of relevant information sources and use appropriate software for analysis of data.
GA 10	Environmental awareness and action	mitigate the effects of environmental degradation, climate change, and pollution. Should develop the technique of effective waste management, conservation of biological diversity, management of biological resources and biodiversity, forest and wildlife conservation, and sustainable development and living.

5.3 Programme Learning Outcomes (PLO)

The term 'programme' refers to the entire scheme of study followed by learners leading to a qualification. Individual programmes of study will have defined learning outcomes that must be attained for the award of a specific certificate/diploma/degree. Programme Learning Outcomes describe what students are expected to know or be able to do by the time of graduation. PLOs are statements about the knowledge, skills and attitudes (attributes) the graduate of a formal engineering program should have. PLOs deal with the general aspect of graduation for a particular program, and the competencies and expertise a graduate will possess after completion of the program. The identified PLOs are as follows:

- **PL01- Knowledge of Computer Application:** Acquiring knowledge on basics of Computer Science and ability to apply to design principles in the development of solutions for problems of varying complexity.
- **PL02- Ability to Solve Complex Problems:** Improved reasoning with strong mathematical ability to Identify, formulate and analyze problems related to computer science and exhibiting a sound knowledge on data structures and algorithms.
- **PL03- Analytical and Critical Thinking:** Ability to devise and conduct experiments, interpret data and provide well informed conclusions. Possessing a sound knowledge on computer application software and design and develop app for applicative problems.
- **PL04- Develop and Demonstrate Creativity:** Ability to design and development of algorithmic solutions to real world problems and acquiring a minimum knowledge on statistics and optimization problems. Establishing excellent skills in applying various

design strategies for solving complex problems.

- **PL05- Enhance Communication Skills:** Must have a reasonably good communication knowledge both in oral and writing.
- **PL06- Formulate Research-Related Skills:** Develop the ability to identify social problems and issues and devise realistic solutions through detailed research by following ethics.
- **PL07- Develop Ability to Collaborate:** Develop the ability to work in teams and figure out the possibilities to collaborate with relevant organisations while solving the problems at hand.
- **PL08- Develop Leadership Qualities:** Develop the qualities that will help in leading a team efficiently and extract maximum throughput out of team effort.
- **PL09- Execute Digital and Technological Skills:** Identify, select and use a modern scientific and IT tool or technique for modeling, prediction, data analysis and solving problems in the area of Computer Science and making them mobile based application software.
- **PO10- Identify Environmental Issues, Develop Awareness and Action:** Exhibiting professional ethics to maintain the integrity in a working environment and also have concern on societal impacts due to computer-based solutions for problems.

5.4 Programme Specific Outcomes (PSOs)

- **PSO1- Knowledge of Computing Systems:** An ability to understand the principles and working of computer systems.
- **PSO2- Project Development Skills:** An ability to understand the structure and development methodologies of software systems.
- **PSO3: Software Development Skills:** Familiarity and practical competence with a broad range of programming languages and open-source platforms.
- **PSO4: Mathematical Skills:** An ability to apply mathematical methodologies to

solve computation task, model real world problem using appropriate data structure and suitable algorithm.

5.5 Course Learning Outcomes (CLOs)

The programme learning outcomes are attained by learners through the essential learnings acquired on the completion of selected courses of study within a programme of study. The term 'course' is used to mean the individual courses of study that make up Course learning outcomes are specific to the learning for a given course of study related to a disciplinary or interdisciplinary/multi-disciplinary area of learning. Some courses of study are highly structured, with a closely laid down progression of compulsory/core courses to be taken at different phases/stages of learning.

5.6 The Qualification Specifications:

Table: 5: NHEQF Qualification specifications

Qualification type	Purpose of the qualification
Undergraduate Certificate	The students will be able to apply technical and theoretical concepts and specialized knowledge and skills in a broad range of contexts to undertake skilled or paraprofessional work and/or to pursue further study/learning at higher levels.
Undergraduate Diploma	The students will be able to apply specialized knowledge in a range of contexts to undertake advanced skilled or paraprofessional work and/or to pursue further learning/study at higher levels.
Bachelor's degree	The students will be able to apply a broad and coherent body of knowledge and skills in a range of contexts to undertake professional work and/or for further learning.
Bachelor's degree (Honours/Honours with Research)	The students will be able to apply the knowledge in a specific context to undertake professional work and for research and further learning.
	The students will be able to apply an advanced body of knowledge in a range of contexts to undertake professional work and apply specialized knowledge and skills for research and scholarship, and/or for further learning relating to the chosen field(s) of learning, work/vocation, or professional practice.

Course Structure and Syllabus of the Framework

B. Sc. IT Course Structure for the Session 2023-2024

1st Semester				
Sl. No.	Subject Code	Names of subjects	Level of Course	Credit
Major				
1	INT052M101	Computer Fundamentals	100	3
2	INT052M102	Introduction to C Programming	100	3
Minor				
3	INT052N101	Fundamentals of Web Design	100	4
Interdisciplinary				
4	IKS992K101	Introduction to Indian Knowledge System-I	100	3
Ability Enhancement Courses (AEC)				
5	AEC982A101	Communicative English and Behavioural Science-I	100	2
Skill Enhancement Courses (SEC)				
6	INT052S101	Windows Programming using C#	100	3
Value Addition Courses (VAC)				
P	VAC-1	Basket Course	100	3
TOTAL				20
2nd Semester				
Sl. No.	Subject Code	Names of subjects	Level of Course	Credit
Discipline Specific Major (Major)				
1	INT052M201	Data Structures	100	3
2	INT052M202	Computer Architecture	100	3
Minor				
3	INT052N201	Server-Side Programming	100	3
Interdisciplinary				
4	IKS992K201	Introduction to Python (Offered By RSIT)	100	3

Ability Enhancement Courses (AEC)				
5	AEC982A201	Communicative English and Behavioural Science-II	100	2
Skill Enhancement Courses (SEC)				
6	INT052S201	Computer Hardware and Networking	100	3
Value Addition Courses (VAC)				
7	VAC992V2409	Basket Course (Cybersecurity - RSIT) (List Offered by University)	100	3
		TOTAL		20
3rd Semester				
Sl. No.	Subject Code	Names of subjects	Level of Course	Credit
Major				
1	INT052M301	Java Programming	200	4
2	INT052M302	Database Management Systems	200	4
Minor				
3	INT052N301	Font End Development with React	200	4
Interdisciplinary				
4	INT052I301	Introduction to Python (Offered to all by RSIT)	200	3
Ability Enhancement Courses (AEC)				
5	AEC982A101	Communicative English and Behavioural Science-III	200	2
Skill Enhancement Courses (SEC)				
6	INT052S301	SEC-3 (System Administration)	200	3
		TOTAL		20
4th Semester				
Sl. No.	Subject Code	Names of subjects	Level of Course	Credit
Major				
1	INT052M401	Operating Systems	200	4
2	INT052M402	Data Communication Networks	200	4
3	INT052M403	Indian Mathematics in Computer Science	200	4
Minor				
4	INT052N401	Front End Development with Angular	200	3
5	INT052N402	Server-Side Programming with Node JS	200	3
Ability Enhancement Courses (AEC)				

6	AEC982A101	Communicative English and Behavioural Science-IV	200	2
TOTAL				20
5th Semester				
Sl. No.	Subject Code	Names of subjects	Level of Course	Credit
Major				
1	C-301	Major Core 1 (High level)	300	4
2	C-302	Major Core 2 (High level)	300	4
3	C-303	Major Core 3 (High level)	300	4
Minor				
4	M-301	Minor 6	300	4
Internship				
5		Internship	300	4
TOTAL				20
6th Semester				
Sl. No.	Subject Code	Names of subjects	Level of Course	Credit
Major				
1	C-304	Major Core 4 (High level)	300	4
2	C-305	Major Core 5 (High level)	300	4
3	C-306	Major Core 6 (High level)	300	4
4	C-307	Major Core 7 (High level)	300	4
Minor				
5	M-302	Minor 7	300	4
TOTAL				20
7th Semester				
Sl. No.	Subject Code	Names of subjects	Level of Course	Credit
Major				
1	C-401	Major Core 1 (Advanced)	400	4
2	C-402	Major Core 2 (Advanced)	400	4
3	C-403	Major Core 3 (Advanced)	400	4
4	C-404	Major Core 4 (Advanced)	400	4
Minor				
5	M-401	Minor 8	400	4
TOTAL				20
8th Semester				
Sl. No.	Subject Code	Names of subjects	Level of Course	Credit
Major				
1	RM-301	Major Core 5 (High level)	400	4
Minor				
2	M-402	Research Methodology	400	4
Dissertation				

3		Dissertation	400	12
Advanced Level Core Course in-lieu of Dissertation				
4	C-407	Major Core 6 (Advanced Level)	400	4
5	C-408	Major Core 7 (Advanced Level)	400	4
6	C-409	Major Core 8 (Advanced Level)	400	4
		TOTAL		20

11. Detailed Syllabus of all the Courses Semester-wise

SYLLABUS (1st SEMESTER)

Paper I/Subject Name: Computer Fundamentals	Subject Code: INT052M101	
Course Type: Major	Course Level: 100	
L-T-P-C – 3-0-0-3	Credit Units: 03	Scheme of Evaluation: T

Course Objective:

The objectives of the course are to give the students exposure to different aspects of computer science.

Prerequisites: None

Course Outcomes

On successful completion of the course the students will be able to:		
SI No	Course Outcome	Blooms Taxonomy Level
CO 1	Define basic concepts of discrete structures and terminology used.	BT 1
CO 2	Explain applications of discrete structures in computer science	BT 2
CO 3	Apply concepts of Counting, Probability, Relations, and Graphs	BT 3
CO 4	Analyse and evaluate various methodology of proving a theorem.	BT 4

Detailed Syllabus:

Modules	Topics	Course content	Periods
I	Representation of Data and Information	Decimal, Binary, Hexadecimal and Octal number system representation of numbers and Characters in Binary. Logic Gates, K-Map, Circuit creation through K-Map, Digital Arithmetics, Example of Sub Adder, Adder, Image and Video representation	15
II	Computer Hardware and Networking	Von Neuman and Havard architecture of Computer, Computer Hardwares Computer Network and Networking Devices, IP concepts, Basic Network commands, Webserver and Web Services, Introduction to HTML and Backend	15
III	Computer Software	Introduction to Computer Software, Classification: Application software, System software (OS types of OS, Loader, Linker, Compiler etc.), Productivity Software, Graphics, Multimedia, Database Management Software.	15
IV	Basics of Programming Language	Introduction to Programming language, Types of Programming Language: High level, Assembly and Machine language, Types of programming paradigms: Imperative, Functional, Logic, Object Oriented	15
Total			60

Credit Distribution		
Lecture/ Tutorial	Practicum	Experiential Learning
3*20 NCH = 60 NCH	-	30 NCH (Internship, Seminar, Case Study, Discussion)

Text Books:

1. *Fundamentals of Computers*. Rajaraman V and Adabala N, 6th Edition, 2014, PHI

Reference Books:

1. Morris Mano, *Digital Logic & Computer Design*, 1st Edition, 2016, Pearson Education India
2. Mandhir Verma, *An Introduction to Principles of Programming*, 1st Edition, 2013, Vayu Education India

Paper II/Subject Name: Introduction to C Programming	Subject Code: INT052M102
Course Type: Major	Course Level:100
L-T-P-C - 2-0-2-3	Credit Units: 03
	Scheme of Evaluation: TP

Objective:

The objectives of the course are to give the students exposure to computer programming and make them capable of using the concepts to solve basic as well as advanced computing problems.

Prerequisites: None

Course Outcomes

On successful completion of the course the students will be able to:		
SI No	Course Outcome	Blooms Taxonomy Level
CO 1	Define and demonstrate the working of C programming language.	BT 1 & 2
CO 2	Apply the programming concepts to solve various problems.	BT 3
CO 3	Analyse and debug the errors while writing the programs.	BT 4
CO 4	Assess and design a new algorithm to solve a new real life problems	BT 5

Detailed Syllabus:

Modules	Topics	Course content	Periods
I	C Programming Fundamentals	History and importance of C language, Basic structure of programs, programming style, execution of C programs. Character set, Tokens, Keywords and Identifiers, Constants, variables, data types, statements, comments, declaration of storage class, assigning values to variables. Basic idea of Computer Algorithms and Flow Charts. Managing I/O, reading and writing characters, formatted Input/output. Arithmetic operators, relational operators, logical operators, assignment operators, increment & decrement operators, conditional operators, bitwise operators, special operators. Arithmetic expressions, operator precedence & associativity.	11
II	Decision Making, Branching & Lopping	Importance of decision making, decision making with <i>if</i> statement, <i>if-else</i> statement, nested <i>if-else</i> statements, <i>switch-case</i> statement, <i>goto</i> statement, the <i>?:</i> operator, examples. Importance of lopping, the <i>while</i> statement, <i>do-while</i> statement, <i>for</i> statement, nested looping, examples.	11

III	Arrays, Strings & User-Defined Functions	Significance of Arrays, creation and use of one- & two-dimensional arrays, Dynamic arrays. Declaration and use of string variables, reading and writing strings, operations on strings. Benefits of user-defined functions, creation and use of user-defined functions, parameter passing, return types.	11
IV	Advanced Programming Concepts	Creation and use of Structures and Unions in programs. Introduction to Pointers, declaration & initialization of pointer variables, accessing a variable through its pointer. Defining, opening & closing files in C, Input/output operations on files.	11
Total			44

Introduction to C Programming Lab Syllabus

Total Lab Hours for the semester = 30 (2 hours per week)

Minimum 20 Laboratory experiments based on the following-

1. Character set, Tokens, Keywords and Identifiers, Constants, variables, data types, statements, comments, declaration of storage class, assigning values to variables.
2. Managing I/O, reading and writing characters, formatted Input/output.
3. Arithmetic operators, relational operators, logical operators, assignment operators, increment & decrement operators, conditional operators, bitwise operators, special operators. Arithmetic expressions, operator precedence & associativity.
4. Importance of decision making, decision making with if statement, if-else statement, nested if-else statements, switch-case statement, goto statement, the ?: operator.
5. Importance of looping, the while statement, do-while statement, for statement, nested looping.
6. Significance of Arrays, creation and use of one & two dimensional arrays, Dynamic arrays.
7. Declaration and use of string variables, reading and writing strings, operations on strings.
8. Benefits of user-defined functions, creation and use of user-defined functions, parameter passing, return types.
9. Creation and use of Structures and Unions in programs.
10. Use of Pointers, declaration & initialization of pointer variables, accessing a variable through its pointer.
11. Defining, opening & closing files in C, Input/output operations on files.

Credit Distribution		
Lecture/ Tutorial	Practicum	Experiential Learning
2 * 22 NCH = 44 NCH	2 * 15 NCH = 30 NCH	8 * 2 NCH = 16 NCH (Problem Solving, Seminar, Case Study, Discussion, Internship, Projects)

Text Book:

1. *Computer Fundamentals and Programming in C*, Reema Thareja, 2nd Edition, 2016, Oxford University Press, Delhi.

Reference Books:

1. E Balaguruswamy, *Computing Fundamentals and C Programming*, 1st Edition, 2017, McGraw Hill.
2. Venugopal and Prasad, *Mastering C*, 2nd Edition, 2017, Tata McGraw Hill.
3. Yashawant Kanetkar, *Let us C*, 15th Edition, 2017, BPB Publication

- **Detailed Syllabus of the Minor Course**

Paper III/Subject Name: Fundamentals of Web Design		Subject Code: INT052N101
Course Type: Minor		Course Level:100
L-T-P-C – 3-0-0-3	Credit Units: 03	Scheme of Evaluation: T

Objective:

The objectives of the course are to enable the students to build a robust foundation for computational thinking and make them learn client-side web development.

Prerequisites: None

Course Outcomes

On successful completion of the course the students will be able to:		
SI No	Course Outcome	Blooms Taxonomy Level
CO 1	Define basic building and design blocks of an website.	BT 1
CO 2	Understand the basic characteristics and concepts of web development.	BT 2
CO 3	Build static web pages and manipulate data using JavaScript and work with the HTML Canvas	BT 3
CO 4	Analyse and evaluate websites in terms of its design and basic processing at the client side.	BT 4 & 5

Detailed Syllabus:

Modu les	Topics	Course content	Periods
I	Introduction to Web and creating website	The Internet: Client & Server, IP address and URL, The World Wide Web (WWW), Installing Visual Studio Code, Installing the Prettier VSCode extension, Install Ubuntu in Windows, using WSL, Install Ubuntu using virtual machine software, making and hosting website. Introduction to HTML tags, Looking inside websites using "Inspect Element"	15
II	Styling and Working with Strings	Working with modern HTML and CSS to produce an attractive, informative multi-page website based on the client's requirements, Creating a multipage website using HTML5, Control the look of a website using CSS, Formating a web page to display complex information, Adding graphical elements and maps to a website, Implement web forms to capture user input, Testing a website for compliance with standards and to ensure that it works with a range of browsers, Implementation of CSS using Bootstrap, Styling and Working with Strings: Introduction to strings, Joining strings together, Switching to the VSCode editor: Putting HTML and JS together, Adding comments to HTML and JS, Find the length of a string, Search for a string inside another string, String equality comparison, Sort a collection of strings, Split strings by a pattern,	15

III	Functions	Numbers, Booleans, Objects and Arrays, Number Data Type, Numbers Boolean Data Type, Boolean - comparisons and logical operations, Object Literals - create, read & update + nesting objects, Arrays - handling ordered values, Functions: Explicitly return a value from a function, Passing a function as an argument , introduction to Firebase.	15
IV	Advanced Techniques of Javascript	Iterating over Arrays: Iterating over an array using the for Each method, Generate an HTML list from an array, Using the index of the array value during iteration, Nested Array iteration, Transforming Arrays, Generate an HTML list from an array using the map function, Using index of array value with map, Transforming Nested Arrays, Filtering Arrays: Filter an array based on some criteria, A minimal UI for filtering flight search results, Use the index of the array value with filter, Building a game with Canvas,HTML canvas element, introduction to AJAX, JSON, RESTful API.	15
Total			60

Credit Distribution		
Lecture/ Tutorial	Practicum	Experiential Learning
3*20 NCH = 60 NCH	-	30 NCH (Problem Solving, Seminar, Case Study, Discussion, Internship, Project)

Text Book:

1. *Internet and World Wide Web How to program*, Deitel H.M. and Deitel P.J, 4th Edition, 2012, Pearson International, New Delhi
2. *Web Technology*, Gopalan N.P. and Akilandeswari J., 2nd Edition, 2014, Prentice Hall of India, New Delhi.
3. *Java How to Program*, Paul Dietel and Harvey Deitel, 8th Edition, 2014, Prentice Hall of India, New Delhi

Reference Books:

1. Uttam K. Roy, *Web Technologies*, 2010, Illustrated Oxford University Press.
2. Godbole A. S. & Kahate A., *Web Technologies*, 2nd Edition, 2006, TMH, New Delhi.

- **Detailed Syllabus of Skill Enhancement Course (SEC-I)**

Paper VI/Subject Name: Windows Programming using C#	Subject Code: INT052S101
Course Type: SEC	Course Level: 100
L-T-P-C - 2-0-2-3	Credit Units: 03
	Scheme of Evaluation: TP

Objective:

The objectives of the course are to enable the students to learn concepts on C# and .NET framework

Prerequisites: None

Course Outcomes

On successful completion of the course the students will be able to:		
SI No	Course Outcome	Blooms Taxonomy Level
CO 1	Define semantic syntax and control structures of C# and .NET	BT 1
CO 2	Understand introductory programming concepts using C#	BT 2
CO 3	Apply logical alternatives with C# decision structures utilizing iteration, class methods, fields, and properties.	BT 3
CO 4	Simplify forms, classes, and controls into C# solutions utilizing arrays and file/database access methods	BT 4

Detailed Syllabus:

Modu les	Topics	Course content	Periods
I	Introduction to .NET and C#	Installation, Components of .NET , Common Language Specification (CLS), Common Language Runtime (CLR), Microsoft Intermediate Language ("MSIL" or "IL"), The Common Type System (CTS), .NET Framework Base Classes, Web Services, Web Forms, and Windows Forms, The .Net Languages, Execution of Sample Programs, Command Line Arguments, Programming Examples, And Multiple Main Methods. Keywords, Identifiers, Literals, Variables, Data Types, Boxing and Unboxing. Operator Precedence and Associativity, Arithmetic Operators, Relational Operators, Logical Operators, Assignment Operators, Increment and Decrement Operators, Conditional Operators, Bitwise Operators, Special Operators, Type Conversions	11
II	Branching, Looping and Methods	Decision Making Statements, The Switch Statement, The? Operator, Decision Making and Looping, Jumps in Loops, Labelled Jumps, Single Dimensional Arrays, Multidimensional Arrays, Jagged Arrays, System. Array Class, Array List Class, Strings, Regular Expressions, Declaring Methods, Main Method, Invoking Methods, Nesting of Methods, Method Parameters	11
III	Structures, Classes, Objects and OOP Concepts	Defining a Structure, Assigning Values to Members, Copying Structures, Structures with Methods, Nested Structures, Classes Vs Structures, Guidelines to use Structures; Enumerations- Enumerator Initialization, Enumerator Base Types, Enumerator Type Conversion, Constructors & Destructors, Member Initialization, 'this' Reference Variable, Nesting of Classes, Members, Properties, Classical Inheritance, Containment Inheritance, defining a Subclass, Visibility Control, Subclass	11

		Constructor, Method Overriding, Hiding Methods, Abstract Classes, Abstract Methods, Sealed Classes, Sealed Methods, Polymorphism	
IV	Exception Handling, Interfaces and Windows Application	An Overview, Exception Handling Syntax, Multiple Catch Statements, The Exception Hierarchy, General Catch Handler, using 'Finally', Nested Try Blocks, User Defined Exceptions, Operators - Checked and Unchecked, Defining Interfaces, Extending Interfaces, Implementing Interfaces, Explicit Interface Implementation, Abstract Classes and Interfaces, Delegates, Multicast Delegates, Events, The Console Class, Console Input and Output, Formatted Output, Custom Numeric Format. Developing Windows Applications, Developing Web Applications.	11
Total			44

Total Lab Hours for the semester = 30 (2 hours per week)

Minimum 20 Laboratory experiments based on the following-

- Basic C# programs
- Classes and Objects
- Inheritance
- Operator Overloading
- Threading, Events and Delegates
- Working with Windows Forms Controls, Validating data
- Creating Custom Dialog Box and Designing an MDI application with Menu
- Retrieving Data from Database & Working with Disconnected Environment

Credit Distribution		
Lecture/ Tutorial	Practicum	Experiential Learning
2 * 22 NCH = 44 NCH	2 * 15 NCH = 30 NCH	8 * 2 NCH = 16 NCH (Problem Solving, Seminar, Case Study, Discussion, Internship, Projects)

Text Book:

1. *Programming in C#, E Balagurusamy, 3rd Edition, 2010, Tata McGraw Hill , New Delhi*

Reference Books:

1. Poul Klausen, *Introduction to programming and C# Language*, Bookbon, 1st 2012, New Delhi.

Objectives:

This foundation course is designed to present an overall introduction to all the streams of IKS relevant to the UG programme. It would enable students to explore the most fundamental ideas that have shaped Indian Knowledge Traditions over the centuries.

Prerequisite: None

Course Outcomes:

On successful completion of the course the students will be able to:		
SI No	Course Outcome	Blooms Taxonomy Level
CO 1	Illustrate literature of Indian civilization-the Vedic - Itihasas, languages, mathematics, and Ayurveda.	BT 2
CO 2	Explain observation of the motion of celestial bodies in the Vedic corpus	BT 3

Modules	Topics	Course content	Periods
I	Bharatavarsha —A Land of Rare Natural Endowments	Demographical features of the ancient Bharatavarsha, Largest cultivable area in the world. Protected and nurtured by Himalayas. The Sindhu-Ganga plain and the great coastal plains. The great rivers of India. Climatic changes: Abundant rains, sunshine and warmth, vegetation, animals and mineral wealth. Most populous country in the world. India's prosperity held the world in thrall. Splendid geographical isolation of India and the uniqueness of Indian culture.	10
II	Foundational Literature of Indian Civilization:	The Vedic Corpus. The Itihasas— Ramayana and Mahabharata, and their important regional versions. The Puranas. Foundational Texts of Indian Philosophies, including the Jaina and Bauddha. Foundational Texts of Indian Religious Sampradayas, from the Vedic period to the Bhakti traditions of different regions. i. The Vedangas and Other Streams of Indian Knowledge System: The Vedic Corpus: Introduction to Vedas and synopsis of the four Vedas and Sub-classification of Vedas; Messages in Vedas; Introduction to Vedāngas : Siksha, Vyakarana, Chandas, Nirukta, Jyotisha and Kalpa ; Vedic Life: Distinctive Features. Other streams of Indian Knowledge System such as Ayurveda, Sthapatya, Natyasastra, Dharmasastra, Arthasastra, etc. The Indian way of continuing the evolution of knowledge through commentaries, interpretations and revisions of the foundational texts. The large corpus of literature in Indian languages. ii. Indian Language Sciences: Language Sciences and the preservation of the Vedic corpus. Varnamala of Indian languages based on classification of sounds on the basis of their origin and effort involved. The special feature of the scripts of most Indian languages, that each symbol is associated with a unique sound. Word formation in Sanskrit and Indian languages. Major insights in the Science of Vyakarana as established by Panini. Important texts of Indian Language Sciences —Siksha or phonetics, Nirukta or etymology, Vyakarana or Grammar, Chandas or Prosody. Navyanyaya and Navya-vyakarana in Navadvipa, Varanasi and West and South India. iii. Indian Mathematics: Numbers, fractions and geometry in the Vedas. Decimal nomenclature of numbers in the Vedas. Zero	24

		and Infinity. Simple constructions from Sulba-sutras. The development of the decimal place value system which resulted in a simplification of all arithmetical operations. Linguistic representation of numbers. Important texts of Indian mathematics. Brief introduction to the development of algebra, trigonometry and calculus. How Indian mathematics continued to flourish in the 18/19/20th centuries. Kerala School. Ramanujan.	
III	Indian Astronomy	Ancient records of the observation of the motion of celestial bodies in the Vedic corpus. Sun, Moon, Nakshatra & Graha. Astronomy as the science of determination of time, place and direction by observing the motion of the celestial bodies. The motion of the Sun and Moon. Motion of equinoxes and solstices. Elements of Indian calendar systems as followed in different regions of India. Important texts of Indian Astronomy. Basic ideas of the planetary model of Aryabhata and its revision by Nilakantha. Astronomical instruments. How Indian astronomy continued to flourish in the 18/19th centuries. Astronomical endeavours of Jaisingh, Sankaravarman, Chandrasekhara Samanta.	15
IV	Indian Health Sciences	Vedic foundations of Ayurveda. Ayurveda is concerned both with maintenance of good health and treatment of diseases. Basic concepts of Ayurveda. The three Gunas and Three Doshas, Panchamahabhuta and Sapta-dhatu. The importance of Agni (digestion). Six Rasas and their relation to Doshas. Ayurvedic view of the cause of diseases. Dinacharya or daily regimen for the maintenance of good health. Ritucharya or seasonal regimen. Important Texts of Ayurveda. Selected extracts from Astāngahrdaya (selections from Sūtrasthāna) and Suśruta-Samhitā (sections on plastic surgery, cataract surgery and anal fistula). The large pharmacopeia of Ayurveda. Charaka and Sushruta on the qualities of a Vaidya. The whole world is a teacher of the good Vaidya. Charaka's description of a hospital. Hospitals in ancient and medieval India. How Ayurveda continued to flourish till 18/19th centuries. Surgical practices, inoculation. Current revival of Ayurveda and Yoga.	17
Total			66

Credit Distribution		
Lecture/ Tutorial	Practicum	Experiential Learning
3 * 22 NCH = 66 NCH	-	8 * 3 NCH = 24 NCH (Problem Solving, Seminar, Case Study, Discussion, Internship, Projects)

Textbooks

1. *Sanskṛta Śāstrom ka Itihās*, Baladev Upadhyaya, 2010, Chowkhambha, Varanasi
2. *A Concise History of Science in India*, D. M. Bose, S. N. Sen and B. V. Subbarayappa, Eds., 22nd Edition, 2010, Universities Press, Hyderabad

Reference Books:

1. Dharampal, *Some Aspects of Earlier Indian Society and Polity and Their Relevance Today*, 1987, New Quest Publications, Pune
2. Dharampal, *Indian Science and Technology in the Eighteenth Century: Some Contemporary European Accounts*, 2021, Dharampal Classics Series, Rashtrotthana Sahitya, Bengaluru
3. Dharampal, *The Beautiful Tree: Indian Indigenous Education in the Eighteenth Century*, 2021, Dharampal Classics Series, Rashtrotthana Sahitya, Bengaluru.
4. J. K. Bajaj and M. D. Srinivas, *Timeless India Resurgent India*, 2001, Centre for Policy Studies, Chennai.

- Detailed Syllabus of Ability Enhancement Course: 1+1 = 2 credits

Paper V/Subject Name: Introduction to Effective Communication

Subject Code: CEN982A101

Course Type: AEC

Course Level: 100

Objectives:

The objectives of this course are to make the students understand the four major aspects of communication by closely examining the processes and figuring the most effective ways to communicate with interactive activities.

Prerequisites: None

Course Outcomes:

On successful completion of the course the students will be able to

SI No	Course Outcome	Blooms Taxonomy Level
CO 1	Identify the elements and processes that make for successful communication and recognise everyday activities that deserve closer attention in order to improve communication skills	BT 1
CO 2	Contrast situations that create barriers to effective communication and relate them to methods that are consciously devised to overcome such hindrance	BT 2
CO 3	Use language, gestures, and para-language effectively to avoid miscommunication and articulate one's thoughts and build arguments more effectively	BT 3

Detailed Syllabus		
Units	Course Contents	Periods
I	<ul style="list-style-type: none"> Introduction to Effective Communication <ul style="list-style-type: none"> • Listening Skills <ul style="list-style-type: none"> ○ The Art of Listening ○ Factors that affect Listening ○ Characteristics of Effective Listening • Guidelines for improving Listening skills 	5
II	<ul style="list-style-type: none"> • Speaking Skills <ul style="list-style-type: none"> ○ The Art of Speaking ○ Styles of Speaking ○ Guidelines for improving Speaking skills ○ Oral Communication: importance, guidelines, and barriers 	5
III	<ul style="list-style-type: none"> • Reading Skills <ul style="list-style-type: none"> ○ The Art of Reading ○ Styles of Reading: skimming, surveying, scanning • Guidelines for developing Reading skills 	5
IV	<ul style="list-style-type: none"> • Writing Skills <ul style="list-style-type: none"> ○ The Art of Writing ○ Purpose and Clarity in Writing 	5

	○ Principles of Effective Writing	
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Credit Distribution		
Lecture/Tutorial	Practicum	Experiential Learning
20 hours	-	10 hours - Movie/ Documentary screening - Peer teaching - Seminars - Field Visit

Textbooks:

1. *Business Communication: Essential Strategies for 21st Century Managers*, Shalini Verma, 2nd Edition, 2014, Vikas Publisher

References Books:

1. P.D. Chaturvedi and Mukesh Chaturvedi, *Business Communication*, 4th Edition, 2017, Pearson Education
2. Meenakshi Raman and Sangeeta Sharma, *Technical Communication: Principles and Practice*, 3rd Edition, 2015, Oxford University Press

Course Type: AEC

Course Level: 100

L-T-P-C – 1-0-0-1

Credit Units: 01

Scheme of Evaluation: TP

Objectives:

The objective of the course is to increase one's ability to draw conclusions and develop inferences about attitudes and behaviour, when confronted with different situations that are common in modern organizations.

Prerequisites: None

On successful completion of the course the students will be able to

SI No	Course Outcome	Blooms Taxonomy Level
CO 1	Understand self & process of self-exploration	BT 2
CO 2	Learn about strategies for development of healthy self-esteem.	BT 2
CO 3	Apply the concepts to build emotional competencies.	BT 3

Detailed Syllabus:

Modules	Course Contents	Periods
I	Introduction to Behavioral Science Definition and need of Behavioral Science, Self: Definition components, Importance of knowing self, Identity Crisis, Gender and Identity, Peer Pressure, Self image: Self Esteem, Johari Window, Erikson's model.	4
II	Foundations of individual behavior Personality- structure, determinants, types of personalities. Perception: Attribution, Errors in perception. Learning- Theories of learning: Classical, Operant and Social	4
III	Behaviour and communication. Defining Communication, types of communication, barriers to communication, ways to overcome barriers to Communication, Importance of Non-Verbal Communication/Kinesics, Understanding Kinesics, Relation between behaviour and communication.	4

IV	Time and Stress Management Time management: Introduction-the 80:20, sense of time management, Secrets of time management, Effective scheduling. Stress management: effects of stress, kinds of stress-sources of stress, Coping Mechanisms. Relation between Time and Stress.	4
T o t a l		16

Credit Distribution		
Lecture/Tutorial	Practicum	Experiential Learning
20 hours	-	10 hours - Movie/ Documentary screening - Peer teaching - Seminars - Field Visit

Text books:

- *Theories and Models in Applied Behavioural Science*, 1991, J William Pfeiffer (ed.), Management; Pfeiffer & Company

Reference Books:

1. Blair J. Kolasa, *Introduction to Behavioural Science for Business*, 1969, John Wiley & Sons Inc
2. K.Alex, *Soft skills*; 2014, S. Chand.

Paper IX/Subject Name: Basket Course 1

Subject Code: VAC-1

Course Type: VAC

Course Level: 100

L-T-P-C - 2-0-2-3

Credit Units: 03

Scheme of Evaluation: TP

List of Value Added Course For UG 1st Semester			
Area	Sl no	Course Title	Course Availability
Knowing India	1	India: Land of Diversity	Open for all
	2	Understanding Sankardeva	Open for all
	3	Introduction to Indian Art: An Appreciation	Not available for Bachelor of Fine Arts
	4	Gandhian Studies	Open for all
	5	Innovation and Startup Ecosystem of India	Open for all
	6	History of India: Ancient to Modern	Not available for BA History
	7	Indian Architectural Heritage	Open for all
	8	Film and Society: An Indian Perspective	Not available for BA JMC
	9	Cultural Heritage Tourism of India	Not available for BA/BScTTM
Healthcare / Yoga	10	Community Health and Social Work	Not available for BSW
	11	Nutrition and Dietetics for Optimal Health	Not available for BSc Nutrition and Dietetics
	12	Sports Psychology	Not available for BA Psychology/Applied Psychology
	13	Comprehensive Healthcare	Open for all
	14	Yoga	Open for all
	15	Stress Management	Open for all
Environment Science and Education	16	Climate Writing	Open for all
	17	Climate Change	Open for all
	18	Chemistry of the Environment	Open for all
	19	Renewable Energy and Sustainable Technology	Open for all
	20	Eco tourism	Not available for BA/BScTTM
	21	Disaster Management	Open for all
Digital Technology	22	Office Automation	Not available for RSIT
	23	Introduction to Graphic Design	Not available for B.Des (Communication Design, Product Design and Graphic Design)

Detailed Syllabus of Value Addition Course (VAC-I)

*** These subjects are Basket Courses that needs to be opted from other Departments/ Schools by the students of RSIT

SYLLABUS (2nd SEMESTER)

Paper I/Subject Name: Data Structures using C++	Subject Code: INT052M201
Course Type: Major	Course Level: 100
L-T-P-C – 2-0-2-3	Credit Units: 03
	Scheme of Evaluation: TP

Objective:

The objectives of the course are to expose the students with the concepts of algorithm design and various types of data structures.

Prerequisites: Basics of C Programming

Course Outcomes

On successful completion of the course the students will be able to:		
SI No	Course Outcome	Blooms Taxonomy Level
CO 1	Define various data structures used in programming.	BT 1
CO 2	Understand the basic constructs of data structure and its implementation.	BT 2
CO 3	Utilise the appropriate data structures to solve a given problem.	BT 3
CO 4	Analyse and evaluate the data structures used for problem solving	BT 4 & 5

Detailed Syllabus:

Modules	Topics	Course content	Periods
I	Linear Data Structure- I	a. Introduction: Why we need data structure? Concepts of data structures: Data and data structure, Abstract Data Type and Data Type. Algorithms and programs, basic idea of pseudo-code. Algorithm efficiency and analysis, time and space analysis of algorithms – order notations. b. Array : Different representations – row major, column major. Sparse matrix - its implementation and usage. Array representation of polynomials. c. Linked List: Singly linked list, circular linked list, doubly linked list, linked list representation of polynomial and applications.	11
II	Linear Data Structure- II	a. Stack and Queue: Stack and its implementations (using array, using linked list applications. Queue, circular queue, dequeuers. Implementation of queue- both linear and circular (using array, using linked list), applications. b. Recursion: Principles of recursion – use of stack, differences between recursion and iteration, tail recursion. Applications - The Tower of Hanoi, Eight Queens Puzzle.	11
III	Nonlinear Data	a. Trees: Basic terminologies, forest, tree representation (using array, using linked list). Binary trees - binary tree traversal (pre-, in-, post- order), threaded binary tree (left, right, full) - non-	11

	Structures	recursive traversal algorithms using threaded binary tree, expression tree. Binary search tree- operations (creation, insertion, deletion, searching). Height balanced binary tree – AVL tree (insertion, deletion with examples only). b. Graphs: Graph definitions and concepts (directed/undirected graph, weighted/un-weighted edges, sub-graph, degree, cut-vertex/articulation point, pendant node, clique, complete graph, connected components – strongly connected component, weakly connected component, path, shortest path, isomorphism). Graph representations/storage implementations – adjacency matrix, adjacency list, adjacency multi-list. Graph traversal and connectivity – Depth-first search (DFS), Breadth-first search (BFS) – concepts of edges used in DFS and BFS (tree-edge, back-edge, cross-edge, and forward-edge), applications. Minimal spanning tree – Prim’s algorithm (basic idea of greedy methods). B-Trees operation	
IV	Searching, Sorting	a. Sorting Algorithms: Bubble sort and its optimizations, insertion sort, shell sort, selection sort, merge sort, quick sort, heap sort (concept of max heap, application – priority queue), radix sort. b. Searching Algorithms: Sequential search, binary search, interpolation search.	11
Total			44

Subject Name: Data Structures using C++ Lab Syllabus

Total Lab Hours for the semester = 30 (2 hours per week)

Minimum 20 Laboratory experiments based on the following-

1. Some common programs of C as revision.
2. Programs on Arrays- Traversal, Insertion, Deletion, Polynomial Representation, etc.
3. Programs on Linked List- Creation Insertion, Deletion, Polynomial Representation, etc.
4. Programs on Stacks-Creation, Push Pop, Infix to Postfix Conversion, Evaluation.
5. Programs on Queues-Creation, Insertion, Deletion, etc.
6. Programs on Trees- Binary Tree Creation, Tree Traversal, BST
7. Programs on Searching- Linear Search, Binary Search
8. Programs on Sorting- Bubble Sort, Insertion Sort, Selection Sort, Quick Sort, Merge Sort, Heap Sort.

Credit Distribution		
Lecture/ Tutorial	Practicum	Experiential Learning
2 * 22 NCH = 44 NCH	2 * 15 NCH = 30 NCH	8 * 2 NCH = 16 NCH (Problem Solving, Seminar, Case Study, Discussion, Internship, Projects)

Text Book:

1. *Data structures, Algorithms and Applications in C++*, S.Sahni, 2nd Edition, 2004, University Press (India) Pvt. Ltd.
2. *Data structures and Algorithms in C++*, Michael T.Goodrich, R.Tamassia and .Mount, 2nd Edition, 2011, John Wiley and Sons

Reference Books:

1. Seymour Lipschutz, *Data Structures*, 1st Edition (reprint) 2017, McGraw Hill Education.
2. Yashavant P. Kanetkar, *Data Structure through C++*, 2nd Edition, 2003, BPB Publications.

Paper II/Subject Name: Computer Architecture	Subject Code: INT052M202
Course Type: Major	Course Level:100
L-T-P-C - 3-0-0-3	Credit Units: 03
	Scheme of Evaluation: T

Objective:

The objectives of the course are to make the students understand the machine instruction, basic computer organization and memory hierarchy with pipelining processing.

Prerequisites: Basics of Digital Logic and Computer Design

Course Outcomes

On successful completion of the course the students will be able to:		
SI No	Course Outcome	Blooms Taxonomy Level
CO 1	Define the different hardware and its working in a Computer Systems in architectural level	BT 1
CO 2	Demonstrate computer architecture concepts related to design of modern processors, memories, and I/O	BT 2
CO 3	Solve problems related to computer Organization and Architecture	BT 3
CO 4	Analyse the performance of commercially available computers in architectural level.	BT 4

Detailed Syllabus:

Modules	Topics	Course content	Periods
I	Introduction to Computer Hardware and Digital Logic	Introduction to computer hardware- what is computer hardware, History of computing, the digital computer, PC versus workstation. Gates, circuits, and combinational logic- Analog and digital systems, Fundamental gates, applications of gates, Introduction to Digital Works, introduction to Boolean algebra, Special-purpose logic elements, Programmable logic, Sequential logic, Combinational Circuits..	15
II	Machine Instruction	Instruction Set Architecture, Assembly language Programming, Addressing modes, Instruction cycle, Registers and storage, RISC versus CISC architecture, Inside CPU.	15
III	Computer Arithmetic & Information Representation	Bits, bytes, words, and characters, Number bases, Number base conversion, Special-purpose codes, Error-detecting codes, Data-compressing codes, Binary arithmetic- half-adder, full-adder, addition of words, Signed numbers- Sign and magnitude representation, Complementary arithmetic, Two's complement representation, One's complement representation, Floating point numbers- Representation, Normalization, Floating point arithmetic, Multiplication and	15

		division.	
IV	CPU, Buses, Peripherals and Memory	Input-Output device such as Disk, CD-ROM, Printer etc., Interfacing with IO device, Keyboard & Display Interface. Buses and input/output mechanisms- The bus, I/O fundamentals, Direct Memory Access, Parallel and serial interfaces. Computer memory- Static and Dynamic memory, Random and Serial Access Memories, Memory hierarchy, Memory technology, Cache memory	15
Total			60

Credit Distribution		
Lecture/ Tutorial	Practicum	Experiential Learning
3*20 NCH = 60 NCH	-	30 NCH (Problem Solving, Seminar, Case Study, Discussion, Internship, Project)

Text Book:

1. *Computer System and Architecture*, Moris Mano, 3rd Edition, 2007, PHI.
2. *Structured Computer Organization*, A. S. Tanenbaum, 5th Edition, 2009, Prentice Hall of India

Reference Books:

1. V. C. Hamacher, Z. G. Vranesic and S. G. Zaky, *Computer Organization*, 5th Edition, 2002 McGraw Hill.
2. J. L. Hennessy and D. A. Patterson, *Computer Architecture: A Quantitative Approach*, 4/e, 2006, Morgan Kaufmann.
3. D. V. Hall, *Microprocessors and Interfacing*, 2nd Edition, 2006, McGraw Hall.

- **Detailed Syllabus of Minor Course**

Paper III/Subject Name: Server-Side Programming	Subject Code: INT052N201
Course Type: Minor	Course Level: 100
L-T-P-C - 3-0-0-3	Credit Units: 03
	Scheme of Evaluation: T

Objective:

The objectives of the course are to teach students the process to build web applications using the Ruby on Rails framework.

Prerequisites: None

Course Outcomes

On successful completion of the course the students will be able to:		
SI No	Course Outcome	Blooms Taxonomy Level
CO 1	Define building blocks of web application in Rubby on Rails framework	BT 1
CO 2	Understand the process of building web applications using Rails database	BT 2
CO 3	Build simple sever side web applications.	BT 3
CO 4	Compare and criticise the design of web applications.	BT 4 & 5

Detailed Syllabus:

Modules	Topics	Course content	Periods
I	Introduction	Using of GitHub, collaboration of code with others using the git tool, an introduction to Ruby, set up a developer environment and VSCode for Ruby and use irb, basics of Ruby programming language, the use of Ruby hashes and how to write recursive methods, POSIX command line and best practices of git	15
II	Object oriented Programming and Database	Introduction to object-oriented programming, define classes and also understand the difference between two types of relationships between classes - Composition and Inheritance Introduction to databases and set up a PostgreSQL database connect to a database from a Ruby application Active Record models to manipulate data. RubyGems development of Rails application and connection to the PostgreSQL database	15
III	HTML, CSS & ERB Pipeline	Basics of the CRUD pattern, designing their HTML pages with CSS and experimenting with using classes, selectors and layouts, basics of the MVC pattern, render dynamic data inside their HTML pages using ERB templates,	15
IV	HTML forms and Rails form helpers & User Authentication	Accept user input on their application via form element in HTML and also using Rails form helper creation of resources using forms, and learn about Cross Site Request Forgery (CSRF), authenticity tokens, ActiveRecord association, migration and validation password storage and play around with browser cookies, sessions, user authentication	15
Total			60

Credit Distribution		
Lecture/ Tutorial	Practicum	Experiential Learning
3*20 NCH = 60 NCH	-	30 NCH (Problem Solving, Seminar, Case Study, Discussion, Internship, Project)

Text Book:

1. *Learn Rails 6: Accelerated Web Development with Ruby on Rails*, Adam Notodikromo ,1st Edition, 2020, Apress

Reference Books:

1. Joseph Joyner, *Ruby on Rails For Beginners: Rails Web Development Programming and Coding Tutorial*, 2nd Edition, 28 September 2015, Minhails Konoplovs

- **Detailed Syllabus of Skill Enhancement Courses (SEC-II)**

Paper VI/Subject Name: Computer Hardware and Networking	Subject Code: CAP052S201
Course Type: SEC	Course Level: 100
L-T-P-C – 3-0-0-3	Credit Units: 03
	Scheme of Evaluation: T

Objective:

The objectives of the course are to explain the different hardware components of a computer system and learn its assembling and disassembling along with various networking devices.

Prerequisites: None

Course Outcomes

On successful completion of the course the students will be able to:		
SI No	Course Outcome	Blooms Taxonomy Level
CO 1	Define different types of Computers and Networking hardware and software	BT 1
CO 2	Understand basic idea of installation process and components of a PC	BT 2
CO 3	Experiment with some hardware components to assemble a computer system or network system.	BT 3
CO 4	Analyse and evaluate different computer systems, network and server for their use.	BT 4 & 5

Detailed Syllabus:

Module s	Topics	Course content	Periods
I	Basics of Computer	Basic Introduction About (Hardware & Software) OS installation (Windows & Linux) , Operating Systems (Edition, Requirement, Types of Installation, Driver Installation) Dual OS installation, Dos Command, Backup and Restore, User Control, Control Panel Computer Peripherals - (Input and Output Devices, Primary Component, Computers Language, Serial and parallel Communication, SMPS) Motherboard (Type, form factor, BUS, IRQ, Chipset, I/O Ports and Connectors, CMOS) Memory (Type, Memory Modules, Development of RAM Comparison of RAM, Virtual Memory, BIOS, POST) Hard Disc (Type, Port, File systems, jumper Setting, Disk Type, Components) Processor (Type, ZIF and SEC, Supports, Virtual Support, Cache, Cores information) External Drives (CD and DVD Drive, Blue-ray, Floppy Disk, Modem, and Printers) Ubuntu (H/W Requirement, basic Command, installation)Assembling and Dis-assembling components, Component upgrade Troubleshooting	09

II	Basics of Computer Networking	Introduction (Types of Networks, Topology, protocols, and Ports) Networking devices (Routers, Switches, Hub, Repeater, NIC Cards, Bridge) Networking Media (Wire, Wireless, Cables, Crimping, UTP) Networking Layers (OSI, TCP/IP) IP Addresses (Version, Classes, Types) Subnetting (VLSM, FLSM, CIDR, Super netting) Setting IP addresses, Sharing files and folders. Network troubleshooting with PING test, ipconfig etc.	09
III	Combinational Logic Circuit Design	Routing, Routing Components, Ports, Network Simulators (CISCO Packet Tracer), Networking Functions (Static, and Default Routing, Password) Dynamic Routing 1 (RIP1, RIP2, Troubleshooting Commands) Dynamic Routing 2 (IGRP, EIGRP, and OSPF) Routing Security (Standard, Extended, Named ACL) Switching 1 (Types, Command, Password, VLAN, and Commands) Switching 2 (Inter VLAN and Commands, Trunking Protocol, VTP, STP) WAN Security (Static Dynamic, and PAT NAT), Basic Network Troubleshooting	09
IV	Servers	Basics of configuring NFS, NIS, DNS, FTP, Squid Proxy, DHCP server Mail server, Web server(Apache), File server(Samba), ip tables and firewall	09
Total			36

Credit Distribution		
Lecture/ Tutorial	Practicum	Experiential Learning
3*20 NCH = 60 NCH	-	30 NCH (Problem Solving, Seminar, Case Study, Discussion, Internship, Project)

Text Book:

1. Computer Hardware & Networking With Free CD, A Panel of Authors, 2nd Edition, 2021, Computech Publications

Reference Books:

1. Ajit Mittal and Ajay Rana, *Mastering Pc Hardware And Networking*, 1st Edition, 2014, Khanna Book Publishing.
2. Joginder Singh Saini and Jagdeep Singh Saini, *Royal new pattern computer hardware & network maintenance*, 1st Edition, 2017, Royal Book Dept.

- **Detailed Syllabus of Indian Knowledge System Course**

Paper IV/Subject Name: Introduction to Indian Knowledge System-II	Subject Code: IKS982I201
Course Type: IKS	Course Level: 100
L-T-P-C – 3-0-0-3	Credit Units: 03
	Scheme of Evaluation: T

Objectives:

The objective of this course is to present an overall introduction to all the streams of IKS relevant to the UG programme. It would enable students to explore the most fundamental ideas that have shaped Indian Knowledge Traditions over the centuries.

Prerequisite: Basic knowledge of IKS-I

Course Outcomes:

On completion of this course students will be expected to –

CO	Contents	BT Level
CO ₁	Recall about classical literature in Sanskrit and other languages	BT 1
CO ₂	Recall traditional Indian knowledge system and Indian education	BT 1
CO ₃	Summarize the Indian Art, Architecture, Agriculture, Polity and Economy	BT 2

Detailed Syllabus:

Module	Course Contents	Periods
I	<p>Classical Literature in Sanskrit and Other Indian Languages: The nature and purpose of Kavya. Drisya and Sravya Kavyas. The ideas of Indian aestheticians on what constitutes the soul of Kavya. Important examples of classical literature in Sanskrit and other Indian languages</p> <p>Indian Education: Preservation of culture, tradition and Dharma through education. Svadhyaya, Pravachana. Also continuity of the family and the vamsha, who are the carriers of knowledge, tradition and Dharma. The extent, inclusiveness and the sophistication of indigenous education in early 19th century India.</p> <p>The Purpose of Knowledge in India: Para Vidya and Aparā Vidya. The corpus connected with Para Vidya. Learning and formalization of concepts associated with Para Vidya also form part of Aparā Vidya. Nature and purpose of sciences, technologies, and all human knowledge concerning the world and the society. The concept of Rita, Dharma. The cycle of mutual dependence of humans and all aspect of creation. Yajna and the inviolable discipline of sharing and caring.</p>	14
II	<p>Methodology of Indian Knowledge System: Systematization of knowledge fields as Sastra. Each Sastra has a clearly defined purpose in Vyavahara. The means of valid knowledge (Pramanas). Perception (Pratyaksha), Inference (Anumana) and Textual Tradition (Agama), as discussed in the canonical texts of all the disciplines. The importance of Pratyaksha and Agama in relation to Anumana.</p> <p>Indian Architecture and Town Planning: The importance of Sthapatya-veda. The ancient cities of the Indus Saraswati region. Town planning and drainage systems. Examples of the significance of architecture and materials in Ramayana and Mahabharata. Public opulence and private austerity in Indian architecture. Why there are many more of Temples than Palaces. Important texts of Architecture and Sculpture. The prevalence of high Indian architecture in almost all parts of India except the Ganga plains.</p>	22

	<p>Examples of high Indian architecture from ancient and medieval periods from different parts of India. The building of Jaipur in the 18th century. How temple art and architecture continue to flourish in modern India.</p> <p><u>Indian Fine Arts:</u> The importance of Gandharva-veda. Natyasastra on the nature and purpose of fine arts. Basic concepts of Indian music and dance. Important texts of Indian music, dance and painting. Indian musical instruments. Different schools of music, dance and painting in different regions of India. Important examples of Indian painting in various part of India. Musicology as a science. Harmonising Lakshya and Lakshana (practise and theory). Major developments in the science and practice of music the 17/18/19th centuries. The current revival of music and dance in India.</p>	
III	<p><u>Indian Agriculture:</u> The significance of agriculture and irrigation as emphasised in the Ramayana, Mahabharata and other texts. Mention of Indian agriculture by the Greek historians and later travellers. Significance of agriculture and irrigation for the kings of Indian tradition. Major water-bodies of the ancient times. The Ery system of south India. Excellence of Indian agricultural technologies as observed by more recent European observers. Productivity of Indian agriculture in medieval Thanjavur and eighteenth century Allahabad, Chengalpattu, etc. Indian attitude towards agriculture, based on Walker and later reports.</p> <p><u>Indian Textiles:</u> India as the ancient home of cotton and silk fabrics. Weaving formed the most significant part of Indian economy after agriculture. Varieties of textiles and dyes developed in different regions of India. India as a leading exporter of textiles in the world in the 17/18/19th centuries.</p> <p><u>Indian Metallurgy:</u> Vedic references to metals and metal working. Mining and manufacture in India of Zinc, Iron, Copper, Gold, etc., from ancient times. Indian texts which refer to metallurgy. Important specimens of metal workmanship preserved/found in different parts of India. The significance and wide prevalence of ironsmith and other metal workers in the pre-modern era. European observers on the high quality and quantity of Indian iron and steel in the 18/19th centuries.</p>	15
IV	<p><u>Indian Polity and Economy:</u> Indian conception of well-organised Polity and flourishing Economy as expounded in the foundational texts. The notion of Bharatavarsha as a Chakravarti-Kshetra and important attributes of Chakravartin. King as the protector of Dharma. King as the strength and support of the weak. King as the protector of Varta. King as the protector of the times. Meaning of Varta: Krishi, Gopalana and Vanijya forming the basis of Varta and the core of economic activity in society. The importance of sharing. Grama as the centre of the polity.</p> <p><u>The Outreach of Indian Knowledge System:</u> The outreach of Indian Knowledge System beyond Indian boundaries forms the ancient times. Outreach to East, Southeast, Central and Southeast Asia of Indian phonetic script, decimal value place system-based arithmetic, algebra, astronomy and calendar, medical pharmacopeia, architecture, methods of making iron and steel, cotton textiles, etc. The transmission of Indian linguistics, knowledge of plants, iron and steel metallurgy, textiles and dyeing, shipbuilding etc., to Europe in 17/18/19th centuries. Current global outreach of Ayurveda, Yoga and Indian Fine Arts.</p>	15
	Total	66

Credit Distribution		
Lecture/ Tutorial	Practicum	Experiential Learning
3 * 22 NCH = 66 NCH	-	8 * 3 NCH = 24 NCH (Problem Solving, Seminar, Case Study, Discussion, Internship, Projects)

Textbooks:

1. *Samskrta Śāstrom ka Itihās*, Baladev Upadhyaya, 2010, Chowkhambha, Varanasi.
2. *A Concise History of Science in India*, D. M. Bose, S. N. Sen and B. V. Subbarayappa, Eds., 2nd Edition, 2010, Universities Press, Hyderabad

Reference Books:

1. Astāngahrdaya, Vol. I, Sūtrasthāna and Śarīrasthāna, Translated by K. R. Srikantha Murthy, Vol. I, Krishnadas Academy, Varanasi, 1991.
2. Dharampal, *Some Aspects of Earlier Indian Society and Polity and Their Relevance Today*, New Quest Publications, Pune, 1987.
3. Dharampal, *Indian Science and Technology in the Eighteenth Century: Some Contemporary European Accounts*, Dharampal Classics Series, Rashtrottana Sahitya, Bengaluru, 2021
4. Dharampal, *The Beautiful Tree: Indian Indigenous Education in the Eighteenth Century*, Dharampal Classics Series, Rashtrottana Sahitya, Bengaluru, 2021.
5. J. K. Bajaj and M. D. Srinivas, *Indian Economy and Polity in Eighteenth century Chengalpattu*, in J. K. Bajaj ed., *Indian Economy and Polity*, Centre for Policy Studies, Chennai, 1995, pp. 63-84.
6. J. K. Bajaj and M. D. Srinivas, *Annam Bahu Kurvita Recollecting the Indian Discipline of Growing and Sharing Food in Plenty*, Centre for Policy Studies, Chennai, 1996.
7. J. K. Bajaj and M. D. Srinivas, *Timeless India Resurgent India*, Centre for Policy Studies, Chennai, 2001.
8. M. D. Srinivas, *The methodology of Indian sciences as expounded in the disciplines of Nyāya, Vyākaraṇa, Ganita and Jyotisa*, in K. Gopinath and Shailaja D. Sharma (eds.), *The Computation Meme: Explorations in Indic Computational Thinking*, Indian Institute of Science, Bengaluru, 2022 (in press).

- Detailed Syllabus of Ability Enhancement Course : 1+1=2 Credits

Paper V/Subject Name: Approaches to Verbal and Non-Verbal Communication	Subject Code: SEN982A201
Course Type: AEC	Course Level: 100
L-T-P-C – 1-0-0-1	Credit Units: 01
	Scheme of Evaluation: TP

Course Objectives

To introduce the students to the various forms of technical communication and enhance their knowledge in the application of both verbal and non-verbal skills in communicative processes.

Course Outcomes

On successful completion of the course the students will be able to:		
SI No	Course Outcome	Blooms Taxonomy Level
CO 1	Identify the different types of technical communication, their characteristics, their advantages and disadvantages.	BT 1
CO 2	Explain the barriers to communication and ways to overcome them.	BT 2
CO 3	Discover the means to enhance conversation skills.	BT 3
CO 4	Determine the different types of non-verbal communication and their significance.	BT 4

Detailed Syllabus

Modules	Topics (if applicable) & Course Contents	Periods
I	Technical Communication Communicating about technical or specialized topics, Different forms of technology-enabled communication tools used in organisations Telephone, Teleconferencing, Fax, Email, Instant messaging, Blog, podcast, Videos, videoconferencing, social media	4
II	Communication Barriers Types of barriers: Semantic, Psychological, Organisational, Cultural, Physical, and Physiological. Methods to overcome barriers to communication.	4
III	Conversation skills/Verbal Communication Conversation – Types of Conversation, Strategies for Effectiveness, Conversation Practice, Persuasive Functions in Conversation, Telephonic Conversation and Etiquette Dialogue Writing, Conversation Control.	4

IV	<p>Non-verbal Communication Introduction; Body language- Personal Appearance, Postures, Gestures, Eye Contact, Facial expressions Paralinguistic Features-Rate, Pause, Volume, Pitch/Intonation/ Voice/ modulation Proxemics , Haptics, Artifacts, Chronemics</p>	4
	Total	16

Texts:

1. Rizvi, M. Ashraf. (2017). *Effective Technical Communication*. McGraw-Hill.
2. Chaturvedi, P. D. and Chaturvedi, Mukesh. (2014). *Business Communication*. Pearson.
3. Raman, Meenakshi and Sharma, Sangeeta. (2011). *Technical Communication: Principles and Practice* (2nd Edition): Oxford University Press.

References:

1. Hair, Dan O., Rubenstein, Hannah and Stewart, Rob. (2015). *A Pocket Guide to Public Speaking*. (5th edition). St. Martin's. ISBN-13:978-1457670404
2. Koneru, Aruna.(2017) *Professional Communication*. New Delhi: Tata McGraw Hill ISBN-13: 978-0070660021
3. Raman, Meenakshi and Singh, Prakash.(2012). *Business Communication* (2nd Edition): Oxford University Press
4. Sengupta, Sailesh.(2011) *Business and Managerial Communication*. New Delhi : PHI Learning Pvt. Ltd.

Paper V/Subject Name: Behavioural Sciences -II	Subject Code: BHS982A102
Course Type: AEC	Course Level: 100
L-T-P-C - 1-0-0-1	Credit Units: 01
	Scheme of Evaluation: T

Course objectives:

To increase one's ability to draw conclusions and develop inferences about attitudes and behaviour, when confronted with different situations that are common in modern organizations.

Course outcomes: On completion of the course the students will be able to:

CO 1: Develop an elementary level of understanding of culture and its implications on personality of people.

CO2: Understand the concept of leadership spirit and to know its impact on performance of employees.

CO3: Understand and apply the concept of Motivation in real life.

Modules	Course Contents	Periods
I	Culture and Personality Culture: Definition, Effect, relation with Personality, Cultural Iceberg, Overview of Hofstede's Framework, Discussion of the four dimensions of Hofstede's Framework.	4
II	Attitudes and Values Attitude's definition: changing our own attitudes, Process of cognitive dissonance Types of Values, Value conflicts, Merging personal and Organizational values	4
III	Motivation Definition of motivation with example, Theories of Motivation (Maslow, McClelland's theory & Theory X and Y)	4
IV	Leadership Definition of leadership, Leadership continuum, types of leadership, Importance of Leadership, New age leaderships: Transformational & transactional Leadership, Leaders as role models.	4
	Total	16

Text books:

1. J William Pfeiffer (ed.) Theories and Models in Applied Behavioural Science, Vol 3, Management, Pfeiffer & Company
2. Blair J. Kolasa, Introduction to Behavioural Science for Business, John Wiley & Sons Inc.
3. Organizational Behaviour by Kavita Singh (Vikas publishers, 3rd Edition).

- **Detailed Syllabus of Value-Added Course (VAC-II)**

Paper VII/Subject Name: Basket Course 2	Subject Code: VAC-2
Course Type: VAC	Course Level: 100
L-T-P-C – 2-0-2-3	Credit Units: 03
	Scheme of Evaluation: TP

***** These subjects are Basket Courses that needs to be opted from other Departments/ Schools by the students of RSIT**

SYLLABUS (3rd SEMESTER)

Paper I/Subject Name: JAVA Programming	Subject Code: INT052M301
Course Type: Major	Course Level:200
L-T-P-C – 3-0-2-4	Credit Units: 03
	Scheme of Evaluation: TP

Objective:

The objectives of the course are to teach the concepts and implementations of object-oriented programming using JAVA language.

Prerequisites: Basics of Procedural or Object-Oriented Programming

Course Outcomes

On successful completion of the course the students will be able to:		
SI No	Course Outcome	Blooms Taxonomy Level
CO 1	Define basic structures, constructs, control structure and syntax of JAVA	BT 1
CO 2	Understand basic idea of object-oriented programming using JAVA	BT 2
CO 3	Apply the concepts of Java, multithreading and Exception handling to develop efficient and error free codes.	BT 3
CO 4	Analyse and evaluate JAVA programs for its efficiency	BT 4 & 5

Detailed Syllabus:

Modules	Topics	Course content	Periods
I	Introduction	A look at procedure-oriented programming, Object-oriented paradigm, Basic concepts of object-oriented programming (OOP) (encapsulation, inheritance, polymorphism), How Java differs from C and C++, Applications of OOP. Overview of JAVA, Use of math functions, comments, Constructing a java program, Introduction of JVM, Command line argument, Data types, Variables: declaration, scope, Type Conversion and Type Casting, Constants, Operators, Evaluation of Expression, Precedence of Operators, Control statements: selection, iteration, and jump.	15
II	Classes and Objects	Class: definition and example, Declaring objects, Method overloading and overriding, Binding: concept of binding, static vs. dynamic binding, Using this and super keywords, Access Control, Inheritance: Extending a class, Final, Abstract classes, Constructors Arrays: one-dimensional and multi-dimensional, Strings: string processing functions	15
III	Packages, Interfaces, Exception Handling	Defining a package, accessing a package and using a package, Interfaces: multiple inheritance, Defining interfaces, implementing interfaces and extending interfaces. Exception handling fundamentals, Exception type: using try...catch, Multiple catch clauses, Throw and Throws Creating threads, Extending the thread class, Stopping and blocking a thread, Life cycle of thread, Threads methods, Thread exceptions	15

IV	Applets and Files	Introduction: local and remote applets, How to write applets, Building applet code, Applet life cycle, Creating an executable applet I/O basics, concept of streams, Stream classes: byte stream classes, character stream classes, I/O exceptions, Creation of files, Random access files	15
Total			60

Text Books:

1. *Programming with Java: A Primer*; Balagurusamy E., 3rd Edition, 2005, Tata McGraw-Hill, New Delhi
2. *Thinking in Java*, Eckel B., 4th Edition, 2006, PHI.

Reference Books:

1. Maurice N. et al, *Java Generics and Collections*, 1st Edition, 2006, O'REILLY Publication.
2. Booch G., Rumbaugh J. Jacobson I., *The Unified Modeling Language User Guide*, 2nd Edition, 2005, Pearson Education.
3. Schildt H., *The Complete Reference Java*, 7th Edition, 2007, Tata McGraw-Hill, New Delhi

JAVA Programming Lab

Objective:

The objectives of this course are to make the students understand and analyze practically the utility of JAVA programming language.

Prerequisites: Basics of Procedural or Object-Oriented Programming

Detailed Syllabus:

Total Lab Hours for the semester = 48 (4 hours per week)

Minimum 20 Laboratory experiments based on the following-

- Write a program in java that outputs your name in giant letters.
- Write a program in Java to find the day of the week of a given date.
- Write a program in Java called Grades Statistics, which reads in n grades (of int between 0 and 100, inclusive) and displays the average, minimum, maximum, and standard deviation.
- Write a program in Java to compute execution time by generating random numbers.
- Write a program in Java to implement the following:
 - a. Tokenize the paragraph into single word.
 - b. Find the number of word in a paragraph?
 - c. Find the number of similar words from the input word.
 - d. Find the number of occurrence of each word.
- Write a program in Java to implement some inheritance hierarchy.
- Design and implement an address book object that contains a person's name, home address and phone number, business address and phone number, and numbers for their fax machine, cellular phone, and pager. Write a program in Java to this test plan for the object and implement a driver [finally prepare a package].
- Write a program in Java to demonstrate the use of try, catch, finally throw and throws keywords and demonstrate the following points in the program.
 - a. Multiple catch blocks.
 - b. try-catch-finally combination.
 - c. try-finally combination.
 - d. Exception propagation among many methods.
 - e. Use of getMessage(), printStackTrace() function of Throwable class.

- f. Nested try blocks
- Write a program that does the following.
 - a. Prompts the user for an input file name through a dialog box.
 - b. Prompts the user for an output file name through a dialog box.
 - c. Copies the input file into the output file, subject to the removal of the space characters listed below from each line.
 - i. The leading space characters
 - ii. The trailing space characters
 - iii. The space characters that are preceded by space characters
- Write a program in Java to design forms.
- Write a program in Java to design a student information form to enter data into the database.
- Write a program in Java to connect some form designed with the back-end database and test them by inserting some records.

Text Books:

1. *Programming with Java: A Primer*; Balagurusamy E., 3rd Edition, 2005, Tata McGraw-Hill, New Delhi
2. *Thinking in Java*, Eckel B., 4th Edition, 2006, PHI.

Reference Books:

1. Maurice N. et al, *Java Generics and Collections*, 1st Edition, 2006, O'REILLY Publication.
2. Booch G., Rumbaugh J. Jacobson I., *The Unified Modeling Language User Guide*, 2nd Edition, 2005, Pearson Education.
3. Schildt H., *The Complete Reference Java*, 7th Edition, 2007, Tata McGraw-Hill, New Delhi

National Credit Hours		
Lecture/ Tutorial	Practicum	Experiential Learning
3* 20 NCH = 60 NCH	2 * 15 NCH = 30 NCH	8 * 2 NCH = 16 NCH (Problem Solving, Seminar, Case Study, Discussion, Internship, Projects)

Paper II/Subject Name: Introduction to Database Management Systems	Subject Code: INT052M302
Course Type: Major	Course Level:200
L-T-P-C – 3-0-2-4	Credit Units: 03
	Scheme of Evaluation: TP

Objective:

The objectives of the course are to make the students learn about databases and the process of designing and constructing data models.

Prerequisites: C/C++, Concepts of Data Structures.

Course Outcomes

On successful completion of the course the students will be able to:		
SI No	Course Outcome	Blooms Taxonomy Level
CO 1	Define various terms used in Database Management system	BT 1
CO 2	Understand the basic concepts and applications of database systems	BT 2
CO3	Apply the basic concepts to design Database	BT 3
CO 4	Evaluate the process Database design, transaction processing and concurrency control	BT 4

Detailed Syllabus:

Modules	Topics	Course content	Periods
I	Introduction	Introduction to Data System, Drawbacks of Conventional File System, Purpose of database systems, DBMS Components, Architecture, Data Independence, Data modelling, Entity Relationship Model, Relational, Network, Hierarchical and object-oriented models, Data Modelling using the Entity Relationship Model.	15
II	Relational Databases	Relational databases, relational algebra, relational calculus. Data definition with SQL, insert, delete and update statements in SQL, views, data manipulation with SQL, triggers and assertions, cursors, Embedded SQL	15
III	Normalization	Relational Database Design guidelines, Integrity Constraints, Domain Constraints, Referential integrity, Functional Dependency, Normalization using Functional Dependencies, Normal forms (1NF, 2NF, 3NF, BCNF), Multi-valued Dependencies and Forth Normal Form, Join Dependencies and Fifth Normal Form, Pitfalls in Relational Database Design, Lossless Non-additive Join Property of Decomposition, Dependency Preserving Decomposition	15

IV	Transaction Processing, Concurrency and Recovery	Introduction. ACID Properties, Schedules and Recoverability -Serializability of Schedules- Concurrency Control, Database Recovery Concepts- Caching, Checkpoints, Transaction Rollback, Case Study-Recovery Techniques in DBMS	15
Total			60

Text Book:

1. *Fundamentals of Database System*, Elmasri, Navathe, 7th Edition, 2016, Pearson Education Asia
2. *Database System Concepts*, Korth H.F., Silberschatz A.; 6th Edition, 2013, Mc Graw Hill.
3. *Introduction to Database Management System*, Kahate A., 1st Edition, 2004, Pearson Educations
4. *DataBase Management System*, Paneerselvam, 2nd Edition, 2011, PHI Learning

Reference Books:

1. Date C.J., *An Introduction to Database Systems*, 8th Edition, 2003, Pearson Education Asia
2. Desai B.C., *An Introduction to Database Systems*, Revised Edition, 2012, Galgotia Publications

Introduction to Database Management Systems Lab
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Objective:

The objectives of the course to teach the student database design and query processing through MySQL.

Prerequisites: C/C++, Concepts of Data Structures

Detailed Syllabus:

Total Lab Hours for the semester = 48 (4 hours per week)

Minimum 20 Laboratory experiments based on the following-

- Creation, altering and dropping of tables and inserting rows into a table (use constraints while creating tables) examples using SELECT command.
- Queries (along with sub Queries) using ANY, ALL, IN, EXISTS, NOTEXISTS, UNION, INTERSET,
- Queries using Aggregate functions (COUNT, SUM, AVG, MAX and MIN), GROUP BY, HAVING and Creation and dropping of Views.
- Queries using Conversion functions (to_char, to_number and to_date), string functions (Concatenation, lpad, rpad, ltrim, rtrim, lower, upper, initcap, length, substr and instr), date functions (Sysdate, next_day, add_months, last_day, months_between, least, greatest, trunc, round, to_char, to_date)
- Creation of simple PL/SQL program which includes declaration section, executable section and exception –Handling section (Ex. Student marks can be selected from the table and printed for those who secured first class and an exception can be raised if no records were found)
- Insert data into student table and use COMMIT, ROLLBACK and SAVEPOINT in PL/SQL block.
- Develop a program that includes the features NESTED IF, CASE and CASE expression. The program can be extended using the NULLIF and COALESCE functions.
- Program development using WHILE LOOPS, numeric FOR LOOPS, nested loops using ERROR Handling, BUILT –IN Exceptions, USE defined Exceptions, RAISE- APPLICATION ERROR.
- Programs development using creation of procedures, passing parameters IN and OUT of PROCEDURES.
- Program development using creation of stored functions, invoke functions in SQL Statements and write complex functions.
- Develop programs using features parameters in a CURSOR, FOR UPDATE CURSOR, WHERE CURRENT of clause and CURSOR variables.

- Develop Programs using BEFORE and AFTER Triggers, Row and Statement Triggers and INSTEAD OF Triggers

Text Book:

1. *Fundamentals of Database System*, Elmasri, Navathe, 7th Edition, 2016, Pearson Education Asia
2. *Database System Concepts*, Korth H.F., Silberschatz A., 6th Edition, 2013, Mc Graw Hill.

Reference Books:

1. Date C.J., *An Introduction to Database Systems*, 8th Edition, 2003, Pearson Education Asia
2. Desai B.C., *An Introduction to Database Systems*, Revised Edition, 2012, Galgotia Publications

National Credit Hours		
Lecture/ Tutorial	Practicum	Experiential Learning
2 * 22 NCH = 44 NCH	2 * 15 NCH = 30 NCH	8 * 2 NCH = 16 NCH (Problem Solving, Seminar, Case Study, Discussion, Internship, Projects)

- **Detailed Syllabus of Minor Course**

Paper III/Subject Name: Front-End Development with React	Subject Code: INT052N301
Course Type: Minor	Course Level: 100
L-T-P-C – 3-0-0-3	Credit Units: 03
	Scheme of Evaluation: T

Objective:

The objectives of the course are to teach the students about React & Type Script to enable them to create web pages.

Prerequisites: Fundamentals of Web Development and Server Programming

Course Outcomes

On successful completion of the course the students will be able to:		
SI No	Course Outcome	Blooms Taxonomy Level
CO 1	Define semantics and syntax of Typescripts.	BT 1
CO 2	Understand static types and know how to port untyped JavaScript	BT 2
CO 3	Apply the concepts learnt to create Single Page Web Applications (SPA) using React, Typescript and Tailwind CSS.	BT 3
CO 4	Inspect different elements of front-end development	BT 4

Detailed Syllabus:

Modules	Topics	Course content	Periods
I	React Fundamentals and Sate Management	Introduction to TypeScript by setting up a development environment, the TypeScript programming language and the React framework, and demonstrates some of the basic concepts that underpin the use of React for building dynamic reactive user interfaces. the Hooks feature of React on the usage of call-back functions and how to use them to build dynamic components that maintain an internal state. Standard hooks and the creation and use of custom hooks. This module also demonstrates state management by building a form and accepting user input.	09
II	Client-side routing	The concept of client-side routing as a separate behaviour from server-side route management. Demonstration of the various aspects of client-side routing such as the use of path parameters, query parameters, programmatic navigation and the operation of links and URLs that are handled client-side.	09
III	Modelling and managing complex states	Managing complex states using the state reducer pattern, and then demonstrates the pattern by implementing it using Reacts use Reducer hook. Introduction to APIs to interface client-side code with the server-side, creating model types to allow interaction to take place, maintain a session with the backend, and working with	09

		pageable APIs	
IV	Production React Apps	Front-end development including the importance of accessibility and WAI-ARIA standards, and use of third-party packages from the NodeJS ecosystem. Production-specific optimizations of a React application, build & deployment process, and configuration of a progressive web app.	09
Total			36

Textbooks:

1. *Learn React with TypeScript 3: Beginner's guide to modern React web development with TypeScript 3*, Carl Rippon, 2018, Pact Publishing.
2. *Full-Stack React, TypeScript, and Node: Build cloud-ready web applications using React 17 with Hooks and GraphQL*, David Choi, 2020, Packt Publishing Limited.

Reference Books:

1. Frank Zammetti, *Modern Full-Stack Development: Using TypeScript, React, Node.js, Webpack, Python, Django, and Docker*, 2nd Edition, 2022, APress

National Credit Hours		
Lecture/ Tutorial	Practicum	Experiential Learning
3*20 NCH = 60 NCH	2*15 NCH=30 NCH	30 NCH (Problem Solving, Seminar, Case Study, Discussion, Internship, Project)

- **Detailed Syllabus of Interdisciplinary Subject**

Paper IV/Subject Name: Introduction to Python	Subject Code: INT052I301
Course Type: IS	Course Level: 200
L-T-P-C - 2-0-1-3	Credit Units: 03
	Scheme of Evaluation: TP

Objective:

The objectives of the course are to teach the students about Programming with Python and use it to solve real world problems.

Prerequisites: Fundamentals of Computers

Course Outcomes

On successful completion of the course the students will be able to:		
SI No	Course Outcome	Blooms Taxonomy Level
CO 1	Define semantics and syntax of Typescripts .	BT 1
CO 2	Understand static types and know how to port untyped JavaScript	BT 2
CO 3	Apply the concepts learnt to create Single Page Web Applications (SPA) using React, Typescript and Tailwind CSS.	BT 3
CO 4	Inspect different elements of front-end development	BT 4

Detailed Syllabus:

Modules	Topics	Course content	Periods
I	Introduction to Python	Introduction to Python Programming: Python interpreter/shell, indentation; identifiers and keywords; literals, numbers, and strings; operators (arithmetic operator, relational operator, Boolean operator, assignment, operator, ternary operator and bitwise operator) and expressions	12
II	Programming With Python	Input and output statements, defining functions, control statements (conditional statements, loop control statements, break, continue and pass, exit function.), default arguments,	12
III	Python Functions and Strings	Python Functions, Python Lambda, Python Arrays, Python Classes/Object, Inheritance, Iterator, Polymorphism, Scope, Modules, Dates, Maths, JSON, RegEx, PIP, User Input , Strings	12
IV	Python Modules	Introduction to Numpy, Pandas, SciPy, Django	12
Total			48

Textbooks:

1. Guttag, J.V. (2016). Introduction to computation and programming using Python. 2nd edition. MIT Press.

Reference Books:

1. Kamthane, A. N., & Kamthane, A.A. (2017) Programming and Problem Solving with Python, McGraw Hill Education.
2. Liang, Y. D. (2013). Introduction to Programming using Python. Pearson Education.

Introduction to Python Programming Lab

Objective:

The objectives of the course to teach the student basics of Python Programming

Prerequisites: None

Detailed Syllabus:

Total Lab Hours for the semester = 48 (4 hours per week)

Minimum 20 Laboratory experiments based on the following-

1. **Hello World Program:**
 - Write a simple Python program to print "Hello, World!" to the console.
2. **Variable Declaration and Printing:**
 - Practice declaring variables of different types (int, float, string) and printing their values.
3. **Basic Arithmetic Operations:**
 - Write Python scripts to perform basic arithmetic operations such as addition, subtraction, multiplication, and division.
4. **Conditional Statements:**
 - Create programs using if-else statements to perform tasks based on certain conditions.
5. **Loops (for and while):**
 - Practice writing for and while loops to iterate over sequences or execute code repeatedly.
6. **Lists and List Operations:**
 - Explore lists in Python and perform operations like appending, removing, and accessing elements.
- Level: Intermediate**
7. **Functions:**
 - Define and call functions to encapsulate reusable code blocks. Practice passing arguments and returning values from functions.
8. **String Manipulation:**
 - Work on tasks involving string manipulation, such as concatenation, slicing, and searching.
9. **File Handling:**
 - Write Python scripts to read from and write to files. Practice handling exceptions during file operations.
10. **Dictionaries and Sets:**
 - Experiment with dictionaries and sets in Python. Perform operations like adding, removing, and accessing elements in dictionaries and sets.
11. **Object-Oriented Programming (OOP) Concepts:**
 - Introduce students to OOP concepts like classes, objects, inheritance, and polymorphism. Have them implement simple classes and explore inheritance hierarchies.
12. **Exception Handling:**

- Practice handling exceptions using try-except blocks to gracefully manage errors in Python programs.
- 13. Data Structures and Algorithms:**
 - Implement common data structures (e.g., stacks, queues, linked lists) and algorithms (e.g., sorting, searching) using Python.
 - 14. Regular Expressions:**
 - Introduce regular expressions and their usage in Python for pattern matching and text processing tasks.
 - 15. Modules and Packages:**
 - Explore the concept of modules and packages in Python. Have students create their own modules and packages and import them into other scripts.
 - 16. GUI Programming with Tkinter:**
 - Introduce GUI programming using Tkinter. Have students create simple graphical user interfaces (GUIs) for basic applications.

Textbooks:

1. Guttag, J.V. (2016). Introduction to computation and programming using Python. 2nd edition. MIT Press.

Reference Books:

1. Kamthane, A. N., & Kamthane, A.A. (2017) Programming and Problem Solving with Python, McGraw Hill Education.
2. Liang, Y. D. (2013). Introduction to Programming using Python. Pearson Education.

National Credit Hours		
Lecture/ Tutorial	Practicum	Experiential Learning
3*16 NCH = 48 NCH	2*15 NCH=30 NCH	22 NCH (Problem Solving, Seminar, Case Study, Discussion, Internship, Project)

• Detailed Syllabus of Ability Enhancement C Courses (AECC-III/IV)

Paper VI/Subject Name: Career Oriented Communication	Subject Code: CEN982A301
L-T-P-C – 1-0-0-1	Credit Units: 01
	Scheme of Evaluation: TP

Objective:

The objectives of the course are to prepare students to adopt different communication strategies and meet the competitive market of employment by considering relevant information related to job requirements.

Prerequisites: Basic understanding of the need to groom oneself for employment and the need for preparation of the same.

Course Outcomes

On successful completion of the course the students will be able to:		
SI No	Course Outcome	Blooms Taxonomy Level
CO 1	Understand the requirement of the job market.	BT 2
CO 2	Build oneself for the competitive market of employment with the concepts learnt.	BT 3

Detailed Syllabus:

Modules	Topics	Course content	Periods
I	Perfecting the Art of Speaking	Informative Speaking Types of informative speaking, Informative versus persuasive topics, techniques of informative speaking, Sample informative speech and its Analysis Persuasive Speaking Characteristics of Persuasion, categorizing types of persuasion, Creating the Persuasive Message, Adapting to the Audience, Building Credibility as a Speaker, Sample Persuasive Speech and its analysis	3
II	Employment communication for Internship and Campus placement	Employability versus employability, filling the industry-academia gap, Enhancing Employability : A five step approach (SWOT, JOHARI, Gathering job related information through research, Planning for employment, writing job suitability statement, reaching out to the prospective employer, preparing for the recruitment and selection process)	3
III	Learning the Written Process	Principles of effective writing Different forms of written communication used in organisations – <ul style="list-style-type: none"> • Business Letters- parts of business letters, Order, acceptance & cancellation, complaint & adjustment letters. • Project report – format and elements Internal office communication - office order, circular, notice, agenda, minutes.	3
IV	Communication for Employment	Preparing Resumes, Job Cover letter, Objectives of Interviews, Types of Interviews, Preparing for the Job interview, Different types of questions asked in Job interview, Qualifying the English Language Test (Synonyms And Antonyms, Confusing Words, Idioms and Phrases, Sentence Completion, Spellings, Grammar, Reading	3

	Comprehension, Verbal logic)	
Total		12

Text Book:

1. *Business Communication: Essential Strategies for twenty-first century Managers*, Verma, Salini. 2nd Edition, 2015, Vikas Publishing House Pvt Ltd. pp 59-86, 119-165, 191-232, 243-259..

Reference Books:

1. Dufrene, Sinha, *BCOM: An Innovative Approach to learning and teaching Business Communication*, Lehman, 2011, Cengage Learning Pvt. Ltd. pp.399-405, 332-355

Paper VII/Subject Name: Behavioral Science-III

Subject Code: BHS982A304

L-T-P-C - 1-0-0-1

Credit Units: 01

Scheme of Evaluation: TP

Objective:

The objectives of the course are:

- **Detailed Syllabus of Skill Enhancement Courses (SEC-III)**

Paper VI/Subject Name: System Administration	Subject Code: INT052S301
Course Type: SEC	Course Level: 200
L-T-P-C – 3-0-0-3	Credit Units: 03
	Scheme of Evaluation: T

Objective:

The objectives of the course are to make the students familiar with python and to explain the process of connecting a Unix/Linux server to the network and share resources on the network.

Prerequisites: Basics of Operating Systems

Course Outcomes

On successful completion of the course the students will be able to:		
SI No	Course Outcome	Blooms Taxonomy Level
CO 1	Define various system administrations command and tools	BT 1
CO 2	Understand the need of basic system administration and tools associated with it .	BT 2
CO 3	Apply system administration command and tools to administer Unix/Linux machines as standalone workstations or in a network	BT 3
CO 4	Analyse different commands of Linux system	BT 4

Detailed Syllabus:

Modules	Topics	Course content	Hours
I	The System Administrator and User Management	Overview of system administration roles and responsibilities Introduction to different operating systems (Linux, Windows) Basics of command-line interface (CLI) and shell scripting Boot and Shut Down: Run levels, Processes and daemons, Configure startup scripts. User Management: Add user, User groups, User and system security, Collapse User environment, Shell startup scripts, What not to do in startup scripts, Other dot files	15
II	File Management, Networking and Backup	File system structure: Manage disk storage, Partition, Format, Fix errors on disk, Mount Links: hard, symbolic, Permission bits, Special permission, ACLs, Quotas. Networking: Network concepts overview, History, ISO/OSI., Layers description, Name to address translation, File sharing with NFS, NIS, Services and inetd. Backup strategy, Selecting the backup devices and software, Automating the backup procedure, Third party product overview, Auto-mounter Requirements and Mechanism	15
III	Backup System Administration	Monitor processes: truss/strace, ps top.\, Monitor network: lsof, netstat, Working with files: strings, awk, od, du, df, find, Misc: which, whereis, dmesg, Logfiles, Operating System	15

	Tools	Installation, System installation, Linux/Solaris installation, Patches, Installing and removing packages (RPM), Download compile and install using source code, Kernel reconfig, Get the kernel source code, Add new adapter and update drivers, Kernel upgrade.	
IV	The proc File system and System Monitoring	Map of /proc, Process entries, Hardware information, Kernel information, Kernel settings, Swap space tunings, Detecting physical memory shortage, System resource loads: CPU, I/O, Disk, Raid disks, Setting limits to processes, Measuring network load.	15
Total			60

Text Book:

1. *Essential System Administration: Tools and Techniques for Linux and Unix Administration*, Aeleen Frisch, 3rd Edition, 2013, O'Reilly Media

Reference Books:

1. Evi Nemeth, Synder, Hein, Whaley, MAckin, *UNIX and Linux System Administration Handbook*, 5th Edition, 2017, Addison Welsley

National Credit Hours		
Lecture/ Tutorial	Practicum	Experiential Learning
3*20 NCH = 60 NCH	-	30 NCH (Problem Solving, Seminar, Case Study, Discussion, Internship, Project)

SYLLABUS (4th SEMESTER)

Paper I/Subject Name: Operating Systems	Subject Code: INT052M401
Course Type: Major	Course Level:200
L-T-P-C – 3-0-2-4	Credit Units: 03
	Scheme of Evaluation: TP

Objective:

The objectives of the course are to teach the basic concepts and functions of operating systems and make them understand the principles of concurrency.

Prerequisites: Concepts of Computer Organization and Architecture

Course Outcomes

On successful completion of the course the students will be able to:		
SI No	Course Outcome	Blooms Taxonomy Level
CO 1	Define & Name terminology and processes associated with Operating System	BT 1
CO 2	Understand the basic concepts of Operating systems.	BT 2
CO 3	Apply the principles of scheduling, and concurrency to solve various problems related to OS	BT 3
CO 4	Analyse and evaluate different OS systems in terms of process management, memory management and I/O systems.	BT 4 & 5

Detailed Syllabus:

Modules	Topics	Course Contents	Hours
I	Operating Systems Overview	Introduction and history of Operating systems, structure and operations; processes and files. Computer System Overview- Basic Elements, Instruction Execution, Interrupts Memory Hierarchy, Cache Memory, Direct Memory Access, Multiprocessor and Multicore Organization. Operating system overview- objectives and functions, Evolution of Operating System.- Computer System Organization- Operating System Structure and Operations- System Calls, System Programs, OS Generation and System Boot	09
II	Process Management and Concurrency Control	Processes- Process Concept, Process Scheduling, Operations on Processes, Interprocess Communication; Threads- Overview, Multicore Programming, Multithreading Models; Thread and SMP Management. Process Synchronization – Critical Section Problem, Mutex Locks, Semaphores, Monitors; CPU Scheduling and scheduling algorithms. Deadlocks- Shared resources, resource allocation and scheduling, resource graph models, deadlock detection, deadlock avoidance, deadlock prevention algorithms	09
III	Storage Management	Memory Management requirements, Memory partitioning: Fixed and Variable Partitioning, Memory Allocation: Allocation	09

		Strategies (First Fit, Best Fit, and Worst Fit), Fragmentation, Swapping, and Paging. Segmentation, Demand paging, Virtual Memory: Concepts, management of VM, Page Replacement Policies (FIFO, LRU, Optimal, Other Strategies), Thrashing. 32 and 64 bit architecture Examples; Allocating Kernel Memory, OS Examples	
IV	I/O and File Systems	I/O Devices, Organization of I/O functions, Operating System Design issues, I/O Buffering, Overview of mass storage structure-disks and tapes. Disk structure – accessing disks, Swap Space. Disk Scheduling (FCFS, SCAN, C-SCAN, SSTF), RAID, Disk Cache. Disk Protection– Goals, Principles, Domain. File System Interface: File Concepts – Attributes – operations – types – structure – access methods. File system mounting. Protection. File system implementation. Directory implementation – allocation methods. Free space Management.	09
TOTAL			36

Text Books:

1. *Operating System Concepts*, Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, 9th Edition, 2012, John Wiley and Sons Inc.

Reference Books:

1. William Stallings, *Operating Systems – Internals and Design Principles*, 7th Edition, 2011, Prentice Hall.
2. Andrew S. Tanenbaum, *Modern Operating Systems*, 2nd Edition, 2001, Addison Wesley.
3. D M Dhamdhare, *Operating Systems: A Concept-Based Approach*, 2nd Edition, 2007, Tata McGraw-Hill Education.

Operating Systems Lab

Objective:

The objectives of the course are to make the students learn about process and disc scheduling practically along with the working of system calls.

Prerequisites: Fundamentals of Computer Programming

Detailed Syllabus:

Total Lab Hours for the semester = 48 (4 hours per week)

Minimum 20 Laboratory experiments based on the following-

1. Basic Linux Commands and Overview.
2. Write Shell Script for followings.
 - To find the global complete path for any file.
 - To broadcast a message to a specified user or a group of users logged on any terminal.
 - To copy the file system from two directories to a new directory in such a way that only the latest file is copied in case there are common files in both the directories.
 - To compare identically named files in two different directories and if they are same, copy one of them in a third directory.

- To delete zero sized files from a given directory (and all its sub- directories).
 - To display the name of those files (in the given directory) which are having multiple links.
 - To display the name of all executable files in the given directory.
 - Write a script to display the date, time and a welcome message (like Good Morning etc.). The time should be displayed with “a.m.” or “p.m.” and not in 24 hours notation.
 - Write a script to display the directory in the descending order of the size of each file.
3. Implementation of FCFS (First Come First Serve) CPU Scheduling.
 4. Implementation of SJF (Shortest Job First) CPU Scheduling.
 5. Implementation of Round Robin (RR) CPU Scheduling.
 6. Implementation of Priority CPU Scheduling Algorithm.
 7. Implementation of FIFO Replacement Algorithm.
 8. Implementation of Optimal Page Replacement Algorithm.
 9. Implementation of LRU Page Replacement Algorithm by Stack method
 10. Implement the producer-consumer problem using threads.

National Credit Hours		
Lecture/ Tutorial	Practicum	Experiential Learning
2 * 20 NCH = 60 NCH	2 * 15 NCH = 30 NCH	30 NCH (Problem Solving, Seminar, Case Study, Discussion, Internship, Projects)

Text Books:

1. *Operating System Concepts*, Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, 9th Edition, 2012, John Wiley and Sons Inc.

Reference Books:

1. William Stallings, *Operating Systems – Internals and Design Principles*, 7th Edition, 2011, Prentice Hall.
2. Andrew S. Tanenbaum, *Modern Operating Systems*, 3rd Edition, 2009, Addison Wesley.
3. D M Dhamdhare, *Operating Systems: A Concept-Based Approach*, 2nd Edition, 2007, Tata McGraw-Hill Education.

Paper I/Subject Name: Data Communications and Networks	Subject Code: INT052M402
Course Type: Major	Course Level:200
L-T-P-C - 3-0-2-4	Credit Units: 03
	Scheme of Evaluation: TP

Objective:

The objectives of the course are to make the students understand the significance and concepts of computer networks along with the layered architecture.

Prerequisites: Basics of internet technologies and graph theory

Course Outcomes

On successful completion of the course the students will be able to:		
SI No	Course Outcome	Blooms Taxonomy Level
CO 1	Define various networking model and their workings	BT 1
CO 2	Understand the significance and concepts of computer networks.	BT 2
CO 3	Apply networking concepts to solve problems and develop networks.	BT 3
CO 4	Analyse and evaluate basic protocols and design issues for layered model.	BT 4 & 5

Detailed Syllabus:

Modules	Topics	Course Contents	Hours
I	Data Link Layer and Medium Access Sub-layer	Design issues, Framing, Error detection and correction codes: checksum, CRC, hamming code, Data link protocols for noisy and noiseless channels, Sliding Window Protocols: Stop & Wait ARQ, Go-back-N ARQ, Selective repeat ARQ, Data link protocols: HDLC and PPP Static and dynamic channel allocation, Random Access: ALOHA, CSMA protocols, Controlled Access: Polling, Token Passing, IEEE 802.3 frame format, Ethernet cabling, Manchester encoding, collision detection in 802.3, Binary exponential back off algorithm	15
II	Network Layer	Design issues, IPv4 classful and classless addressing, subnetting, Routing algorithms: distance vector and link state routing, Congestion control: Principles of Congestion Control, Congestion prevention policies, Leaky bucket and token bucket algorithms	15
III	Transport Layer	Elements of transport protocols: addressing, connection establishment and release, flow control and buffering, multiplexing and de-multiplexing, crash recovery, introduction to TCP/UDP protocols and their comparison	15
IV	Application Layer	World Wide Web (WWW), Domain Name System (DNS), E-mail, File Transfer Protocol (FTP), SMTP, HTTP, Introduction	15

		to Network security	
TOTAL			60

Text Books:

1. *Data and Computer Communication*, William Stallings, 10th Edition, 2013, PHI.
2. *Data Communications and Networking*, Behrouz A Forouzan, 4th Edition, 2017, Tata McGraw Hill
3. *Computer Networks*, Tannenbaum, 3rd Edition, 1996, Pearson Education.

Reference Books:

1. L.L. Peterson & B.S. Davie, *Computer Networks: A Systems Approach*, 5th Edition, 2011, Morgan Kaufmann
2. Anuranjan Misra, *Computer Networks*, 2006, Acme Learning, Morgan Kaufman Publication, New Delhi
3. Bhushan Trivedi, *Computer Networks*, Reprint Edition, 2011, Oxford press

Data Communication and Networks Lab

Objective:

The objectives of the course are to make the students learn socket programming and to make them familiar with simulation tools.

Prerequisites: Fundamentals of Computer Programming and Data Communication

Detailed Syllabus:

Total Lab Hours for the semester = 48 (4 hours per week)

Minimum 20 Laboratory experiments based on the following-

- To study various topologies for establishing computer networks.
- To learn the usage of various basic tools (crimping, krone etc.) used in establishing a LAN.
- To familiarize with switch and hub used in networks.
- To learn the usage of connectors and cables (cabling standards) used in networks
- To make certain copper and fiber patch cords using different standards.
- To familiarize with routers & bridges
- Use commands like ping, ipconfig for trouble shooting network related problems.
- NIC Installation & Configuration (Windows/Linux)
- TCP/UDP Socket Programming
- Multicast & Broadcast Sockets
- Develop a program to compute the Hamming Distance between any two code words.
- Develop a program to compute checksum for an 'm' bit frame using a generator polynomial.
- IPC (Message queue)
- Implementation of a Prototype Multithreaded Server
 - Implementation of o Data Link Layer Flow Control Mechanism (Stop & Wait, Sliding Window)
 - Data Link Layer Error Detection Mechanism (Cyclic Redundancy Check)
 - Data Link Layer Error Control Mechanism (Selective Repeat, Go Back N)

National Credit Hours		
Lecture/ Tutorial	Practicum	Experiential Learning
3 * 20 NCH = 30 NCH	2 * 15 NCH = 30 NCH	30 NCH (Problem Solving, Seminar, Case Study, Discussion, Internship, Projects)

Text Books:

1. *Data and Computer Communication*, William Stallings, 10th Edition, 2013, PHI.
2. *Data Communications and Networking*, Behrouz A Forouzan, 4th Edition, 2017, Tata McGraw Hill
3. *Computer Networks*, Tannenbaum, 3rd Edition, 1996, Pearson Education.

Reference Books:

1. L.L. Peterson & B.S. Davie, *Computer Networks: A Systems Approach*, 5th Edition, 2011, Morgan Kaufmann
2. Anuranjan Misra, *Computer Networks*, 2006, Acme Learning, Morgan Kaufman Publication, New Delhi
3. Bhushan Trivedi, *Computer Networks*, Reprint Edition, 2011, Oxford press

Paper I/Subject Name: Indian Mathematics in Computer Science	Subject Code: INT052M402
Course Type: Major	Course Level:200
L-T-P-C - 3-1-0-4	Credit Units: 04
	Scheme of Evaluation: TP

Objective:

The objectives of the course are to provide a comprehensive knowledge on Vaidic mathematics and uses of IKS in Computer Science

Prerequisites: Concepts of Computer Programming and Basic Mathematics

Course Outcomes

On successful completion of the course the students will be able to:		
SI No	Course Outcome	Blooms Taxonomy Level
CO 1	Define various networking model and their workings	BT 1
CO 2	Understand the significance and concepts of computer networks.	BT 2
CO 3	Apply networking concepts to solve problems and develop networks.	BT 3
CO 4	Analyse and evaluate basic protocols and design issues for layered model.	BT 4 & 5

Detailed Syllabus:

Modules	Topics	Course content	Periods
I	Introduction to Ancient Mathematics & Astronomy	Introduction to Brief introduction of inception of Mathematics & Astronomy from vedic periods. Details of different authors who has given mathematical & astronomical sutra (e.g. aryabhata, bhaskara, brahmagupta, varamahira, budhyana, yajanvlkya, panini, pingala.	15
II	Ancient Mathematics -I	Veda & Sulvasutras (Pythagoras theorem, Square root & Squaring Circle) (baudhayana sulbhasutra, apastamba sulbhasutra, katyayana sulbhasutra, manava sulbhasutra, maitrayana sulbhasutra, varaha sulbhasutra, vadhula sulbhasutra Pingala's chandasutras, sunya, yaat-tavat, Aryabhata (Aryabhata, Asanna, ardha-jya, kuttaka,) bhaskara (trigonometry,shridhara, mahavira), Bhaskara Acharya (Sidhantashiromani), Varamahira panchasiddhantika.	15
III	Ancient Mathematics -II	Brahmagupta (vargaprakrati, bhramasphuta siddhanta, bhavana), ayatavrtta, ganitasarasamgraha, lilavathi, ganesadaivajna, randavantika, suryasiddhanta, grahalaghava, sadratnamala, mandavrtta, sigrartta, Bijaganita, Bakshali	15

		manuscript Golavada, Madhyamanayanaprakara, Mahajyanayanaprakara (Method of Computing Great Sines), Lagnaprakarana, Venvaroha, Sphutacandrapti, Aganita-grahacara , Chandravakyani (Table of Moon-mnemonics)	
IV	Use of Indian Knowledge in Computer Science	NLP and Sanskrit, Use of Vaidic Mathematics as Programming, Ancient Indian Geometric Concept in Computer Graphics . Case Studies	15
Total			60

Indian Mathematics in Computer Science Lab

Objective:

The objectives of the course are to provide a comprehensive knowledge on Vaidic mathematics and its application in Computer Science

Prerequisites: Fundamentals of Vaidic Mathematics

Detailed Syllabus:

Total Lab Hours for the semester = 48 (4 hours per week)

Minimum 20 Laboratory experiments based on the following-

- **Sutras (Mathematical Formulas):** Vedic mathematics is based on a set of concise and easily memoizable aphorisms called "sutras," which serve as guiding principles for performing mathematical operations. Write Programs using any language to demonstrate these Sutras and check its performance with traditional programs.
- **Mental Calculation Techniques:** Vedic mathematics emphasizes mental calculation techniques that allow for rapid computation without the need for pen and paper. These techniques are particularly useful for performing arithmetic operations such as addition, subtraction, multiplication, and division. Write Programme using Mental Calculation Techniques and check its effectiveness.
- **Vertically and Crosswise Method:** One of the fundamental techniques in Vedic mathematics is the vertically and crosswise multiplication method, which provides a systematic approach to multiplying large numbers quickly and efficiently. Create a Program to apply this technique .
- **Digit Sums and Casting Out Nines:** Vedic mathematics employs techniques such as digit sums and casting out nines to check the accuracy of calculations and detect errors. Create a Programm to apply this technique
- **Algebraic Techniques:** Vedic mathematics includes algebraic techniques for solving equations, factorization, and simplification of expressions, which are based on the underlying principles of the sutras. Create programming solutions based on these .
- **Project-Based Learning with Python:** Encourage students to undertake programming projects that explore real-world applications of Vedic mathematics principles in computer science. For example, they could develop programs that use Vedic mathematics techniques in cryptography, algorithm design, or optimization problems.

Text Book:

1. "Indian Mathematics: Engaging with the World from Ancient to Modern Times," by GG Josheph, speaking Tiger, 2016 .
2. "Ancient Indian Leaps into Mathematics",BS Yadav, , Brikausher publication, 2010

Reference Books:

1. R P Kulkarni, Glimpse of Indian Engineering and Technology (Ancient & Medieval period, Munshiram Manoharlal Publishers Pvt. Ltd. 2018

National Credit Hours		
Lecture/ Tutorial	Practicum	Experiential Learning
3 * 20 NCH = 60 NCH	2 * 15 NCH = 30 NCH	30 NCH (Problem Solving, Seminar, Case Study, Discussion, Internship, Projects)

- **Detailed Syllabus of Minor Course**

Paper III/Subject Name: Front-End Development with Angular	Subject Code: INT052N401
Course Type: Minor	Course Level: 200
L-T-P-C - 3-0-0-3	Credit Units: 03
	Scheme of Evaluation: T

Objective:

The objectives of the course are to teach the students about Angular to enable them to create web pages.

Prerequisites: Fundamentals of Web Development and Server Programming

Course Outcomes

On successful completion of the course the students will be able to:		
SI No	Course Outcome	Blooms Taxonomy Level
CO 1	Define Angular framework and its use.	BT 1
CO 2	Understand the fundamentals of the Angular framework and its architecture.	BT 2
CO 3	Develop Angular applications using components, modules, services, and dependency injection.	BT 3
CO 4	Implement routing and navigation to create single-page applications (SPAs).	BT 4

Detailed Syllabus:

Modules	Topics	Course content	Periods
I	Introduction to Angular	Overview of front-end development and Angular framework Setting up Angular development environment (Node.js, npm) Creating and running a basic Angular application	15
II	Angular Components & Modules	Understanding Angular components and component architecture, Creating and using components, templates, and data binding, Component communication using input/output properties and event emitters Introduction to Angular modules and their role in application organization, Creating and importing modules in Angular applications, Implementing services for data sharing and business logic	15
III	Angular Routing and Navigation	Configuring routes and route parameters in Angular applications Implementing navigation and routing guards Lazy loading modules for optimized application loading	15
IV	Reactive Programming with Angular	Understanding reactive programming concepts and observables, Managing application state with RxJS operators Building reactive forms for user input and validation Making HTTP requests and handling responses in Angular Integrating external APIs and services into Angular	15

		applications Error handling and authentication with HTTP interceptors	
Total			60

Textbooks:

1. *Angular Development with TypeScript* by Yakov Fain and Anton Moiseev
2. *Full-Stack React, TypeScript, and Node: Build cloud-ready web applications using React 17 with Hooks and GraphQL*, David Choi, 2020, Packt Publishing Limited.

Reference Books:

- Frank Zammetti, *Modern Full-Stack Development: Using TypeScript, React, Node.js, Webpack, Python, Django, and Docker*, 2nd Edition, 2022, APress

National Credit Hours		
Lecture/ Tutorial	Practicum	Experiential Learning
3*20 NCH = 60 NCH	-	30 NCH (Problem Solving, Seminar, Case Study, Discussion, Internship, Project)

- **Detailed Syllabus of Minor Course**

Paper III/Subject Name: Server-Side Programming with Node JS		Subject Code: INT052N401
Course Type: Minor		Course Level: 200
L-T-P-C - 3-0-0-3	Credit Units: 03	Scheme of Evaluation: T

Objective:

The objectives of the course are to teach the students about Node JS and it's frame work to enable them to create back end of web sites.

Prerequisites: Fundamentals of Web Development and Server Programming

Course Outcomes

On successful completion of the course the students will be able to:		
SI No	Course Outcome	Blooms Taxonomy Level
CO 1	Define basic semantics and syntax of Node JS to work in server-side programming	BT 1
CO 2	Understand the principles and advantages of server-side programming with Node.js.	BT 2
CO 3	Apply asynchronous programming techniques using callbacks, promises, and async/await	BT 3
CO 4	Implement data storage and retrieval using databases (e.g., MongoDB, MySQL) with Node.js.	BT 4

Detailed Syllabus:

Modules	Topics	Course content	Periods
I	Introduction to Node JS & Asynchronous Programming	Overview of server-side programming and Node.js Installing Node.js and npm, Writing and running basic Node.js applications Understanding asynchronous programming and non-blocking I/O, using callbacks, promises, and async/await for handling asynchronous operations, Error handling and best practices for asynchronous programming	15
II	Express.js framework	Introduction to Express.js framework for building web applications and APIs Creating routes, handling requests, and sending responses with Express Middleware concept and implementation in Express.js	15
III	Data Storage & Retrieval	Working with databases in Node.js (MongoDB, MySQL) Connecting to databases and executing CRUD operations Implementing data validation and error handling, Database Integration, Authentication and Authorization	15
IV	Error Handling and Middleware	Implementing error handling middleware in Express.js Using third-party middleware for request processing and	15

		logging, Best practices for middleware development and management Deployment Strategies and Production Considerations	
Total			60

Textbooks:

1. *"Node.js Design Patterns"* by Mario Casciaro.
2. *Full-Stack React, TypeScript, and Node: Build cloud-ready web applications using React 17 with Hooks and GraphQL*, David Choi, 2020, Packt Publishing Limited.

Reference Books:

- Frank Zammetti, *Modern Full-Stack Development: Using TypeScript, React, Node.js, Webpack, Python, Django, and Docker*, 2nd Edition, 2022, APress

National Credit Hours		
Lecture/ Tutorial	Practicum	Experiential Learning
3*20 NCH = 60 NCH	-	30 NCH (Problem Solving, Seminar, Case Study, Discussion, Internship, Project)

- **Detailed Syllabus of Ability Enhancement Compulsory Courses (AECC-III/IV)**

Paper VI/Subject Name: Communication and Presentation Skills	Subject Code: CEN982A401
L-T-P-C – 1-0-0-1	Credit Units: 01
	Scheme of Evaluation: TP

Objective:

The objectives of the course are to prepare students to develop report writing skills, deliver effective presentation and be informed about technology-enabled communication in the 21st century.

Prerequisites: Basic writing skills in English.

Paper VII/Subject Name: Behavioral Science-IV	Subject Code: BHS982A404
L-T-P-C – 1-0-0-1	Credit Units: 01
	Scheme of Evaluation: TP

Objective:

The objectives of the course are:

*These course will be updated as per university norms during ongoing semester .